

**Stream Habitat and Fish Distribution in the Jones Creek Drainage,
Chattahoochee-Oconee National Forest, GA, 2001**



United States Department of Agriculture Forest Service
Southern Research Station
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1650 Ramble Rd.
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2004

Table of Contents

Introduction	2
Study Area	2
Methods	2
Fish Inventory	2
Habitat Inventory	3
Results	4
Fish Inventory	4
Habitat Inventory	4
Jones Creek, entire	4
Jones Creek, section 1	5
Jones Creek, section 2	5
Jones Creek, section 3	5
Jones Creek, section 4	6
Lance Creek	6
Big Stamp Creek	6
Discussion	6
Literature Cited	9
Acknowledgements	10
Figures and Tables	11
Appendix A: Habitat Inventory Results	16
Jones Creek, entire	17
Jones Creek, section 1	23
Jones Creek, section 2	28
Jones Creek, section 3	33
Jones Creek, section 4	38
Lance Creek	43
Big Stamp Creek	48
Appendix B: Fish Inventory Results	53
Appendix C: Habitat Inventory Categories	59

Introduction

In summer 2001, the USDA Forest Service, Southern Research Station, Center for Aquatic Technology Transfer (CATT) and Chattahoochee-Oconee National Forest (CONF) personnel performed stream fish and habitat inventories on Jones Creek and two of its tributaries in the upper Etowah River drainage. The CONF wished to address several issues, including:

- 1) distribution and abundance of fish species within the drainage, with particular interest in the Federally Endangered Etowah darter (*Etheostoma etowahae*),
- 2) description of stream habitat conditions within the drainage,
- 3) possible effects of a dam on habitat and fish distribution in Jones Creek.

Fish and habitat conditions in the Jones Creek drainage have been monitored since the mid-1950's by the CONF and the Georgia Department of Natural Resources (GADNR). Fish, habitat, and water temperature data are available mostly from the upper portion of the watershed, which is managed as a brown trout fishery. Few data have been collected between the confluence with the Etowah River and the dam located 6.1 km upstream. Results of our inventories can be used to describe habitat conditions throughout the drainage and the distribution and relative abundance of fish species downstream of the dam. These data are particularly useful when used in conjunction with information previously collected by the CONF and GADNR.

Study Area

Jones Creek is a tributary to the upper Etowah River that flows mostly through Forest Service managed lands (Figure 1). In July 2001, we inventoried 14.8 km of Jones Creek beginning at its confluence with the Etowah River. We divide the stream into four sections for data analysis based on the location of pertinent stream features and distinct changes in stream channel type. Section 1 extends from the confluence with the Etowah River to the 4 m high waterfall located at 2.7 km. Section 2 extends from the waterfall to the dam (often referred to as the 'dry dam') located at 6.1 km. Section 3 extends from the dam to the start of a higher gradient section at 10.7 km. Section 4 extends from the start of the higher gradient section to the end of the inventory at 14.8 km. Separate habitat inventories were performed on Lance Creek beginning at its confluence with Jones Creek and ending 3.5 km upstream, and on Big Stamp Creek beginning at its confluence with Jones Creek and ending 1.8 km upstream.

Methods

Fish Inventory

We sampled fish in sections 1 and 2, between the confluence with the Etowah River and the dam located 6.1 km upstream (Figure 1). We used three-pass depletion electrofishing to sample fish in every 10th pool and 10th riffle designated during the stream habitat inventory (see below) using 2 or 3 (depending on habitat unit size) 800 V AC backpack electrofishing units. Fish were identified to species and the number of each species collected during each pass was recorded. Length and weight data were

collected for brown trout (*Salmo trutta*), redeye bass (*Micropterus coosae*), and Etowah darters. All fish were returned to the habitat unit from which they were collected. No fish data were collected upstream of the dam or in either tributary.

Habitat Inventory

We used a modified version of the two-stage basin-wide visual estimation technique (BVET) (Dolloff et al. 1993) to inventory stream habitat. During the first stage, one crew member identified each habitat unit by type, estimated length, wetted width, average and maximum depth, dominant and subdominant substrates, instream cover, and embeddedness for each habitat unit, and estimated riffle crest depth at the downstream end of pools. Habitat unit types included pools, glides, riffles, runs, and cascades (Table C1). Glides were grouped with pools for data analysis. Runs and cascades were grouped with riffles for data analysis. The length (0.1 m) of each habitat unit was measured with a hip chain and wetted width was visually estimated. Average depth of each habitat unit was estimated by taking depth measurements at various places across the channel profile with a graduated staff marked in 5 cm increments. Dominant substrate was visually estimated as the substrate size class (Table C2) covering the greatest amount of the wetted channel in each habitat unit, subdominant substrate covered the second greatest area. Cover provided by rock, wood, and undercut banks was visually estimated in linear meters. Cover was defined as structure within the wetted channel under which a 15 cm long object could be hidden from overhead view. The percent of the total substrate surface area that was embedded was visually estimated. Substrate was considered embedded if interstitial spaces around large substrate particles were filled by sand, silt, or clay.

The second crew member classified and inventoried large woody debris (LWD) within the stream channel, estimated bank instability, and recorded data on a paper datasheet. LWD was divided into seven classes (Table C3). All woody debris less than 1 m long and less than 5 cm in diameter were omitted from the survey. Bank instability was estimated for both left and right banks. Bank instability was defined as the percent of the bank between the edge of the wetted channel and the top of the bankfull channel that consisted of exposed erodible materials.

The first unit of each habitat type selected for intensive (second stage) sampling (i.e. accurate measurement of wetted width) was determined randomly. Additional units were selected systematically (every 10th unit for each habitat type). The width of each systematically selected habitat unit was measured with a 30-m measuring tape at intervals ranging from about 1 m to 15 m. Interval size was determined by the length and the morphology of the unit (i.e. interval of measured width increased with increasing unit length). In each of the systematically selected (second stage) riffles we also estimated the bankfull stream channel width and riparian width as described by Harrelson et al. (1994), and measured channel gradient. We estimated bankfull channel width by measuring the width of the bankfull channel

perpendicular to flow. We estimated riparian width by measuring from the edge of the bankfull channel to the intersection with the nearest landform at an elevation of two-times the maximum bankfull depth. Surveys were terminated at pre-determined locations. All surveys were conducted while wading upstream.

The relationship between estimated surface area and measured surface area typically is strongly and positively correlated when the estimates are made by experienced personnel; thus we could correct visual estimates by multiplying them by a calibration ratio. The calibration ratio, the estimated true total area, and the variance of the area estimator were calculated separately for each habitat type and each stream (or stream section if survey divided into separate reaches, for example lower and upper). Stream habitat and fish data were converted from paper to electronic format between 2001 and 2004 by CONF personnel. Spreadsheets were delivered to the CATT in 2004 and BVET calculations were computed with a Microsoft Excel spreadsheet using the formulas found in Dolloff et al. (1993). Data were summarized by the CATT using Excel spreadsheets and SigmaPlot graphics software. We provide separate habitat inventory analysis for Jones Creek, lower Jones Creek (from the confluence with the Etowah River to the waterfall at 2.7 km), Lance Creek, and Big Stamp Creek.

Results

Fish Inventory

We collected a total of 14 species of fish in 6 families between the confluence with the Etowah River and the dam (sections 1 and 2) (Table 1). The most abundant and widely distributed species are the creek chub (*Semotilus atromaculatus*), Alabama hogsucker (*Hypentelium etowanum*), and banded sculpin (*Cottus carolinae*). The least common species is the Etowah darter. We captured two Etowah darters (58-59 mm, 1.9-2.3 g) in a single riffle located in section 1, approximately 1.8 km upstream from the confluence with the Etowah River (Figure 2, Tables B1, B2). Thirty brown trout (60-400 mm, 12-763 g) were captured in 11 different habitat units beginning 1.1 km upstream from the confluence with the Etowah River. Nineteen redeye bass (80-212 mm, 6-108 g) were captured in six habitat units, all within the first 2.5 km of the lower section. Several species, including redeye bass, blackbanded darter (*Percina nigrofasciata*), yellowfin shiner (*Notropis lutipinnus*), bluehead chub (*Nocomis leptocephalus*), and largescale stoneroller (*Campostoma oligolepis*) are restricted to section 1, downstream of the 4 m high waterfall (Figure 2).

Habitat Inventory

See Tables 2 – 5 to compare habitat attributes between sections. See Appendix A for detailed habitat inventory results, including habitat attribute summary tables and figures for each section.

Jones Creek, entire

Overall, the 14.8 km section of Jones Creek beginning at the confluence with the Etowah River has an average bankfull channel width of 8 m and gradient of 3 percent. Nearly 70 percent of the total

surface area consists of slow water habitats (pools and glides; hereafter referred to as pools), where sand is the most common dominant substrate. Substrate in fast water habitats (riffles, runs, and glides; hereafter referred to as riffles) is dominated by cobbles, bedrock, and large gravel. Areas of unstable banks are scattered throughout the reach with concentrated areas of instability upstream of the dry dam at 6.1 km and near the confluence with Lance Creek at 10.8 km. A total of 81 percent of pools and 25 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 101 pieces of LWD per km, with the majority of pieces less than 5 m long and 50 cm in diameter (sizes 1 and 2).

Jones Creek, section 1

The 2.7 km section of Jones Creek between the confluence with the Etowah River and the 4 m high waterfall has an average bankfull channel width of 12 m and gradient of 1 percent. Nearly 80 percent of the total surface area consists of pools, where sand is the most common dominant substrate. The dominant substrate in the majority of riffles is bedrock with sand and silt subdominant, but several riffles are dominated by cobble with large gravel subdominant. Areas of unstable banks are scattered throughout the reach with few concentrated areas of instability. A total of 94 percent of pools and 0 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 88 pieces of LWD per km, with the majority of pieces greater than 5 m in length (sizes 4, 5, and 6).

Jones Creek, section 2

The 3.4 km section of Jones Creek between the 4 m high waterfall and the dry dam has an average bankfull channel width of 10 m and gradient of 2 percent. Nearly 75 percent of the total surface area consists of pools, where sand is the most common dominant substrate. The dominant substrate in over 70 percent of riffles is cobble, with large gravel as the typical subdominant substrate. Areas of unstable banks are scattered throughout the reach with few concentrated areas of instability. A total of 84 percent of pools and 2 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 71 pieces of LWD per km, with the majority of pieces 5 – 10 cm in diameter (sizes 1 and 4).

Jones Creek, section 3

The 4.6 km section of Jones Creek between the dry dam and the start of the higher gradient section has an average bankfull channel width of 10 m and gradient of 1 percent. Over 65 percent of the total surface area consists of pools, where sand is the most common dominant substrate. The dominant substrate in nearly 60 percent of riffles is cobble, with large gravel as the typical subdominant substrate. A concentrated area of unstable banks is located near the beginning of the reach, just upstream of the dry dam. A total of 65 percent of pools and 4 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 36 pieces of LWD per km, with the majority of pieces 5 – 10 cm in diameter (sizes 1 and 4).

Jones Creek, section 4

The 4.1 km section of Jones Creek between the beginning of the higher gradient section and the end of the habitat inventory reach has an average bankfull channel width of 5 m and gradient of 4 percent. Over 50 percent of the total surface area consists of pools, where sand is the most common dominant substrate. The dominant substrate in the majority of riffles is cobble or large gravel, with small gravel and sand as the typical subdominant substrates. A concentrated area of unstable banks occurs near the beginning of the reach, near the confluence with Lance Creek. A total of 86 percent of pools and 48 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 208 pieces of LWD per km, with the majority of pieces less than 5 m long and less than 50 cm in diameter (sizes 1 and 2).

Lance Creek

The 3.5 km section of Lance Creek beginning at the confluence with Jones Creek has an average bankfull channel width of 6 m and gradient of 3 percent. Over 30 percent of the total surface area consists of pools, where sand is the most common dominant substrate. The most common dominant substrate in riffles was cobble, with small gravel as the typical subdominant substrate. Areas of unstable banks are scattered throughout the reach with few concentrated areas of instability. A total of 98 percent of pools and 87 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 146 pieces of LWD per km, with the majority of pieces 10-50 cm in diameter (sizes 2 and 5).

Big Stamp Creek

The 1.8 km section of Big Stamp Creek beginning at the confluence with Jones Creek has an average bankfull channel width of 4 m and gradient of 7 percent. Thirty percent of the total surface area consists of pools, where sand is the most common dominant substrate. The most common dominant substrates in riffles are cobble and bedrock, with small gravel and sand as the typical subdominant substrates. Areas of unstable banks are scattered throughout the reach. A total of 97 percent of pools and 79 percent of riffles are embedded over 35 percent by sand, silt, or clay. There are 167 pieces of LWD per km, with the majority of pieces less than 5 m long and less than 50 cm in diameter (sizes 1 and 2).

Discussion

The major controls on fish species distributions within the drainage are the waterfall at the upstream end of section 1 and changes in stream habitat, such as increased gradient and woody debris in section 4. Nine of the 14 species present downstream of the waterfall (section 1) are absent from section 2. We did not collect fish upstream of the dam, but GADNR and CONF fisheries records indicate that of the 5 species we captured between the waterfall and the dam, all are currently present upstream of the dam with the exception of the bronze darter (*Percina palmaris*). No darters have been documented upstream of the dam since the mid-1950's suggesting that the dam may serve as an artificial movement barrier preventing some fish species from accessing sections of upper Jones Creek.

Upper Jones Creek is actively managed as a trout fishery. Brown, rainbow and brook trout have been stocked there since at least the mid-1950's and a wild population of brown trout exists today. In 1984 over 150 fish cover structures were added within section 4 to increase habitat quality for trout. The presence of the structures is reflected in our habitat data by the increased occurrence of LWD and LWD cover in the section (Appendix A). Populations are largest in section 4 and gradually decrease in downstream sections. Few occur within the current range of Etowah darters in Jones Creek, limiting the possibility of predation (Leftwich and Dolloff 1994) or population fragmentation via behavioral changes (Roberts 2003).

The Etowah darter is present downstream of the 4 m high waterfall in the lower mainstem of Jones Creek. Although only two individuals were captured, the find is significant in that it extends the known range of Etowah darters within the Etowah River drainage. We are unable to provide a population estimate due to extremely low captures, but can document occurrence as far as 1.8 km upstream from the confluence with the Etowah River. Although we did not capture Etowah darters upstream of the waterfall at the end of section 1, some sections may contain suitable habitat. Preferred habitat for the Etowah darter is described by Butler (1994) as follows...

*The Etowah darter inhabits warm and cool, medium and large creeks or small rivers that are moderate or high gradient with rocky bottoms. It is found in relatively shallow riffles, with large gravel, cobble, and small boulder substrates. The Etowah darter is typically associated with the swiftest portions of shallow riffles, but occasionally adults are taken at the tails of riffles. The sites having the greatest abundance of Etowah darters had clear water and relatively little silt in the riffles. The Etowah darter, like other members of the subgenus *Nothonotus*, shuns pool habitats and is intolerant of impoundment.*

The Etowah darters in section 1 were captured in a 160 m² riffle containing cobble and large gravel substrates and with an average depth of 15 cm and average depth of 38 cm. Most riffles in sections 2 and 3 have cobble and large gravel substrates and are similar in size, depth, and gradient to the riffle where Etowah darters are found in section 1. Presently, the greatest numbers of Etowah darter are found in the mainstem of the Etowah River and they are not typically associated with smaller tributary systems. The waterfall at the upstream end of section 1 marks the upstream extent of distribution for several fish species in Jones Creek and may also be the natural extent of Etowah darter distribution within the drainage. Despite its limited numbers and distribution any future management plans for the watershed must consider possible impacts on the Etowah darter.

Currently the only management activity within the watershed is prescribed burning and future activities may include shortleaf pine restoration. Recreation activities include fishing, hunting, and

horseback riding. Water quality is considered the overriding issue for the watershed and it has been selected for a watershed assessment (Mitzi Cole, pers. comm.). Limiting future sediment inputs will benefit trout reproduction in upper Jones Creek (Waters 1995) and encourage Etowah darters persistence in lower Jones Creek (Butler 1994). The CONF can limit sediment inputs by repairing areas with unstable banks, such as near the dam (Appendix A), and by limiting activities that disturb soils within the watershed. The CONF should continue to work with its partners in a coordinated effort to monitor stream habitat and fish populations within the watershed.

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Acknowledgements

We would like to thank the CONF for providing funding and logistic support for the project. Members of the CATT summer crew 2001, CONF personnel, and the Georgia Department of Natural Resources collected the data presented here. Monte Seehorn and David Walters provided assistance during the fish inventory.

Figures and Tables

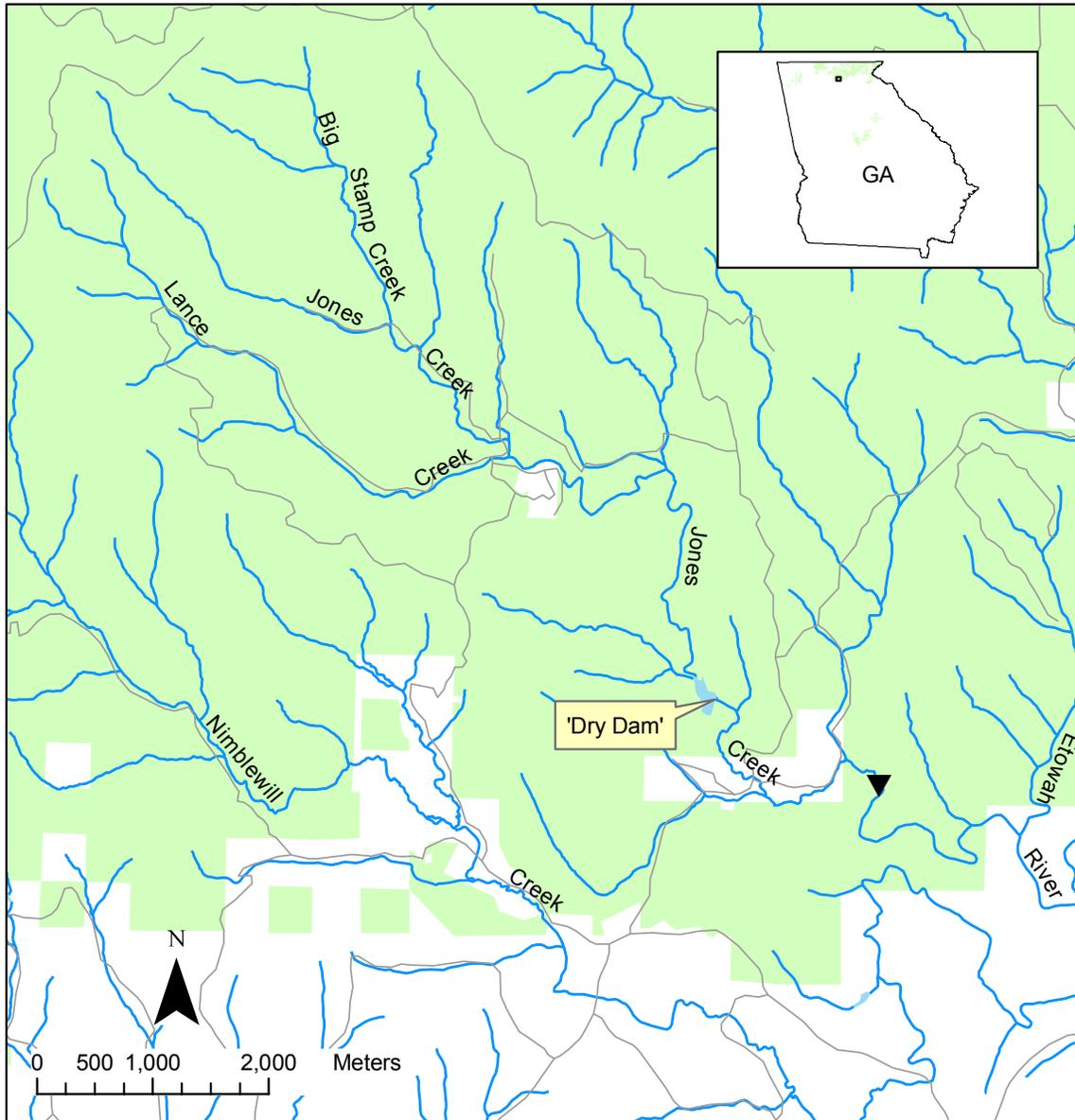


Figure 1. Jones Creek watershed with location of 'dry dam' (6 km upstream from confluence with Etowah River) and waterfall (triangle, 2.7 km upstream from confluence). Etowah darters were captured in riffle 26 (1.8 km upstream from confluence).

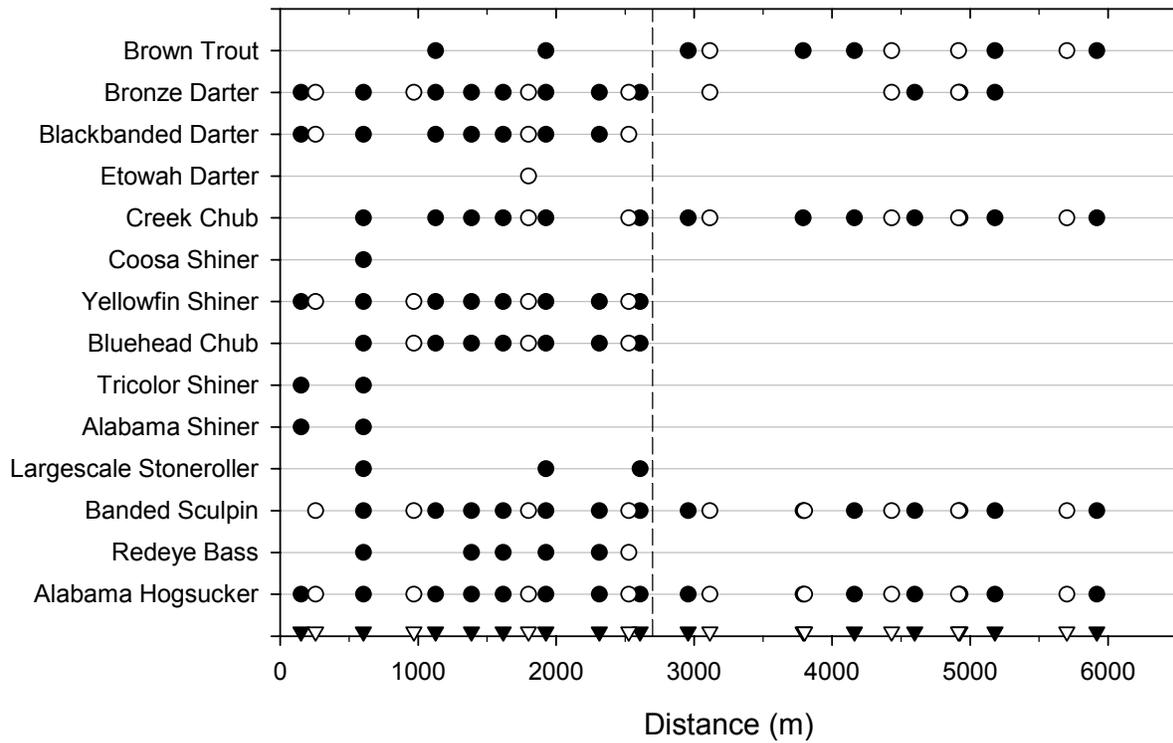


Figure 2. Location of species captured by backpack electrofishing in Jones Creek, summer 2001. Closed circles represent pools where species were captured. Open circles represent riffles where species were captured. Closed triangles represent locations where pools were electrofished. Open triangles represent riffles that were electrofished. Dashed vertical line is location of 4 m high waterfall. Sampling ended at the dry dam located at 6000 m. Distance is number of meters upstream of confluence with Etowah River.

Table 1. Total number of each species captured by electrofishing in Jones Creek, summer 2001.

CommonName	Family	Genus	Species	Total
Alabama hogsucker	Catostomidae	<i>Hypentelium</i>	<i>etowanum</i>	297
Redeye bass	Centrarchidae	<i>Micropterus</i>	<i>coosae</i>	19
Banded sculpin	Cottidae	<i>Cottus</i>	<i>carolinae</i>	154
Largescale stoneroller	Cyprinidae	<i>Campostoma</i>	<i>oligolepis</i>	4
Alabama shiner		<i>Cyprinella</i>	<i>callistia</i>	15
Tricolor shiner		<i>Cyprinella</i>	<i>trichroistia</i>	19
Bluehead chub		<i>Nocomis</i>	<i>leptocephalus</i>	80
Yellowfin shiner		<i>Notropis</i>	<i>lutipinnis</i>	289
Coosa shiner		<i>Notropis</i>	<i>xaenocephalus</i>	4
Creek chub		<i>Semotilus</i>	<i>atromaculatus</i>	593
Etowah darter	Percidae	<i>Etheostoma</i>	<i>etowahae</i>	2
Blackbanded darter		<i>Percina</i>	<i>nigrofasciata</i>	39
Bronze darter		<i>Percina</i>	<i>palmaris</i>	46
Brown trout	Salmonidae	<i>Salmo</i>	<i>trutta</i>	30

Table 2. Location of start and end points and total section lengths for BVET habitat inventories performed on Jones Creek, July 2001.

	Start Point		End Point		Total Length (km)
	Landmark	Distance (km)	Landmark	Distance (km)	
Jones Creek, entire:	Etowah River	0.0	no landmark	14.8	14.8 km
Jones Creek, section 1:	Etowah River	0.0	waterfall	2.7	2.7 km
Jones Creek, section 2:	waterfall	2.7	dry dam	6.1	3.4 km
Jones Creek, section 3:	dry dam	6.1	high gradient riffle	10.7	4.6 km
Jones Creek, section 4:	high gradient riffle	10.7	no landmark	14.8	4.1 km

Table 3. Summary of pool attributes for BVET habitat inventories performed on Jones Creek, July 2001. See Table 1 for section descriptions.

Section:	Entire	1	2	3	4
Percent of Total Stream Area:	69	78	74	66	52
Number:	574	79	94	152	249
Number per km:	39	29	28	33	60
Mean Area (m ²):	122	261	186	148	36
Mean Maximum Depth (cm):	56	77	60	64	44
Mean Average Depth (cm):	34	45	35	39	27
Mean Residual Pool Depth (cm):	16	28	18	18	11
Surveyed as Glides (%):	3	8	9	1	0
> 35% Embeddedness (%):	81	94	84	65	86

Table 4. Summary of riffle attributes for BVET habitat inventories performed on Jones Creek, July 2001. See Table 1 for section descriptions.

Section:	Entire	1	2	3	4
Percent of Total Stream Area:	31	22	26	34	48
Number:	320	37	53	73	157
Number per km:	22	14	16	16	38
Mean Area (m ²):	98	159	116	156	52
Mean Maximum Depth (cm):	30	49	31	36	23
Mean Average Depth (cm):	16	20	18	21	12
Surveyed as Runs (%):	0	0	0	0	0
Surveyed as Cascades (%):	4	8	0	1	6
> 35% Embeddedness (%):	25	0	2	4	48
Mean Bankfull Channel Width (m):	8	12	10	10	5
Mean Channel Gradient (%):	3	1	2	1	4

Table 5. Summary of large woody debris (pieces per km) for BVET habitat inventories performed on Jones Creek, July 2001. See Table 1 for section descriptions.

Section:	Entire	1	2	3	4
< 5 m long, 5 cm – 10 cm diameter:	34	21	24	12	75
< 5 m long, 11-50 cm diameter:	25	6	4	2	79
< 5 m long, >50 cm diameter:	0	0	0	0	1
> 5 m long, 5 cm – 10 cm diameter:	14	24	29	10	1
> 5 m long, 11-50 cm diameter:	18	17	8	3	44
> 5 m long, >50 cm diameter:	4	14	1	1	3
Rootwads:	6	6	4	8	6
Total:	101	88	71	36	208

Appendix A: Habitat Inventory Results

Stream:	Jones Creek (entire)
District:	Toccoa
USGS Quadrangle:	Campbell Mountain/Nimblewill
Survey Date:	07/16/01
Downstream Starting Point:	Confluence with Etowah River
Total Distance Surveyed (km):	14.8

	Pools	Riffles
Percent of Total Stream Area:	69	31
Number:	574	320
Number per km:	39	22
Total Area (m ²):	70007±3593	31255±1632
Mean Area (m ²):	122	98
Correction Factor:	1.02	1.09
# of Paired Samples:	53	31
Mean Maximum Depth (cm):	56	30
Mean Average Depth (cm):	34	16
Mean Residual Pool Depth (cm):	16	--
% of Pool Habitat Surveyed as Glides:	3	--
% of Riffle Habitat Surveyed as Runs:	--	0
% of Riffle Habitat Surveyed as Cascades:	--	4
> 35% Embeddedness (%):	81	25

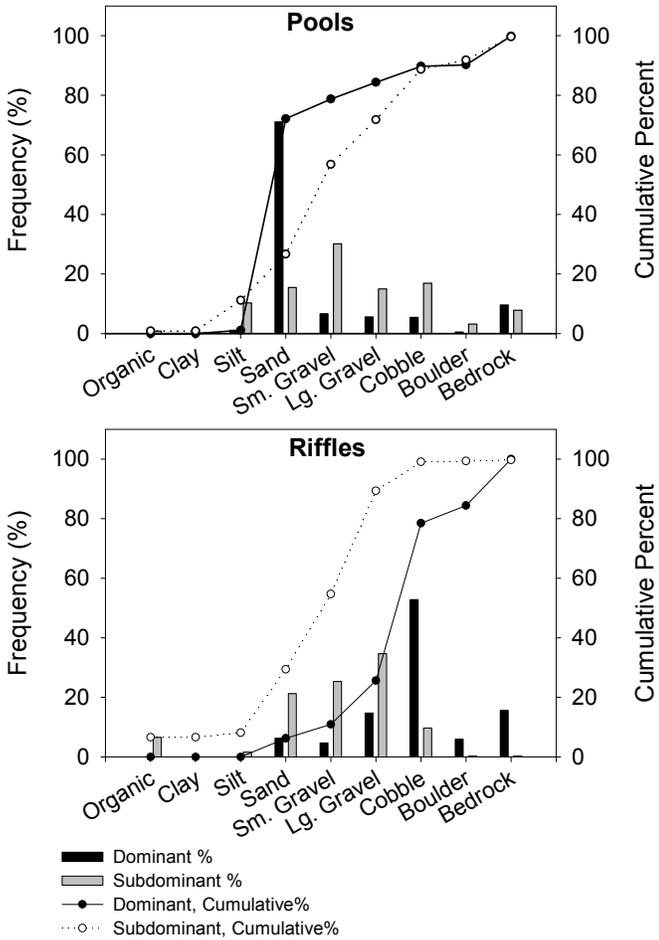
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	34
< 5 m long, 11-50 cm diameter:	25
< 5 m long, >50 cm diameter:	0
> 5 m long, 5 cm – 10 cm diameter:	14
> 5 m long, 11-50 cm diameter:	18
> 5 m long, >50 cm diameter:	4
Rootwads:	6
Total:	101

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	47	19
Maximum	217	150
75 th Percentile	43	14
25 th Percentile	15	3
Minimum	6	0

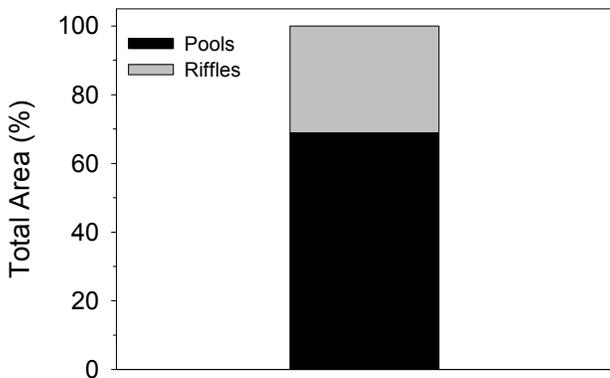
*Left riparian, right riparian, and bankfull channel widths were added together for calculations

**Left and right riparian widths were grouped (not added) together for calculations

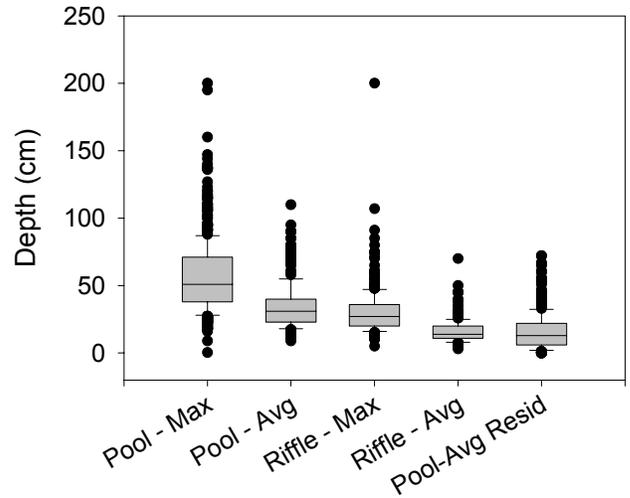
Other Stream Attributes	
Mean Bankfull Channel Width (m):	8
Mean Channel Gradient (%):	3



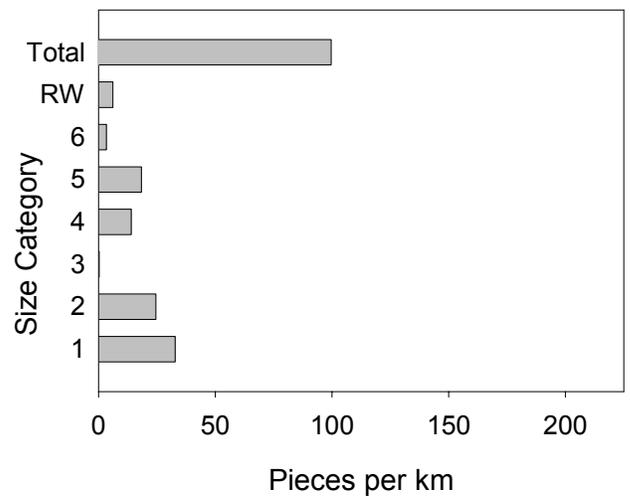
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Jones Creek (entire), summer 2001.



Estimated area of Jones Creek (entire) in pools and riffles as calculated using BVET techniques, summer 2001.



Maximum and average depths and residual pool depths for pools and riffles in Jones Creek (entire), summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.

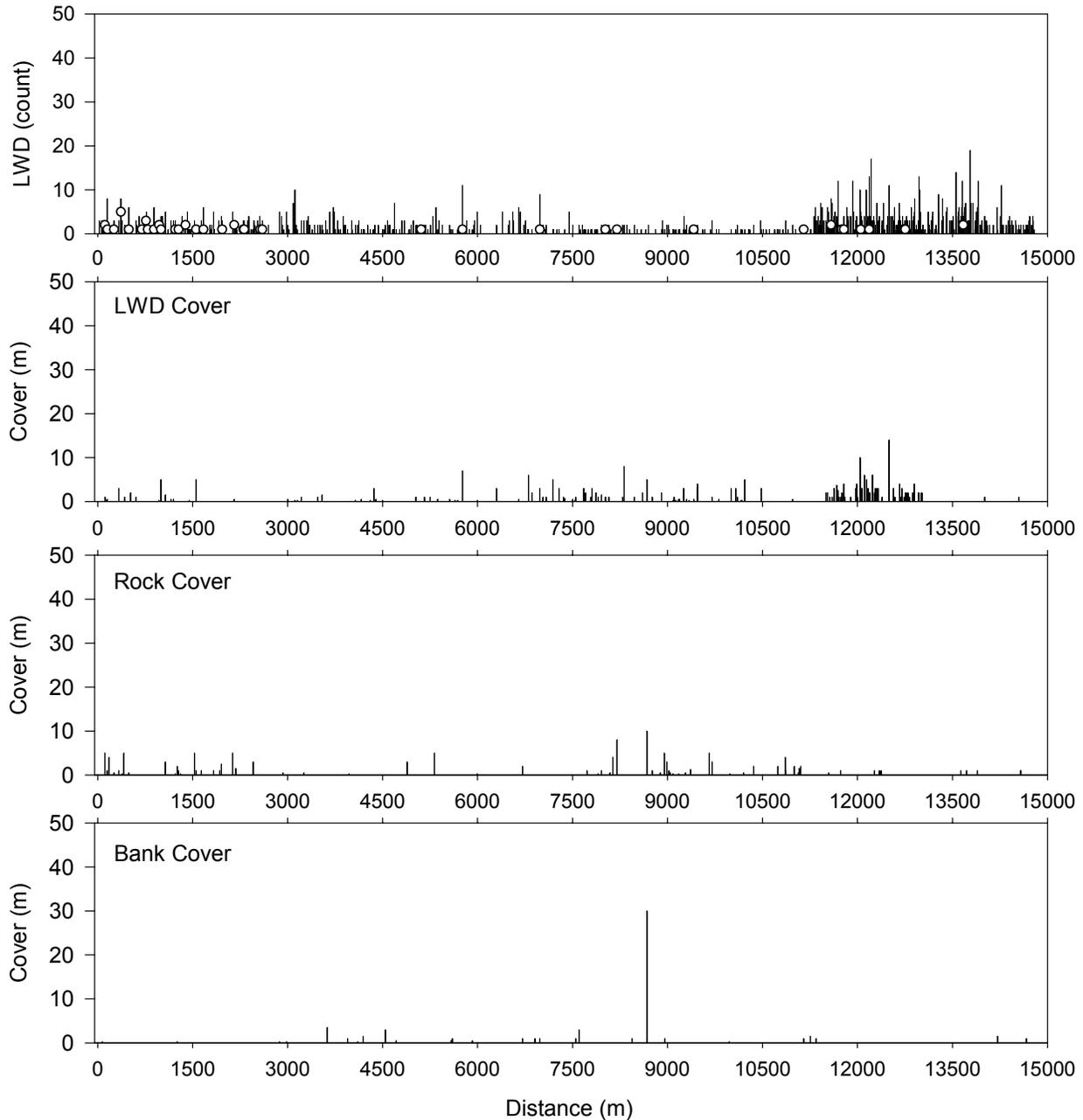


LWD per kilometer in Jones Creek (entire), summer 2001.

Stream features found on Jones Creek (entire) during BVET habitat survey, summer 2001. Distance is meters from confluence with Lance Creek.

Stream Feature	Distance (m)	Width (m)	Comments
SEEP	254.5	0.5	clean-cold
TRIBUTARY	324.8	0.3	right side, 0.3 little flow
TRIBUTARY	352.7		
SEEP	412.5		left side
TRIBUTARY	583.0	1.5	right side, good flow
TRIBUTARY	1289.4	0.3	left side, little flow
TRIBUTARY	1796.2	0.5	
TRIBUTARY	2412.0	1.0	left side, little flow
RUN	2634.4	4.0	deep, fast chute (run)
FALL	2694.0		4 m high
TRIBUTARY	2749.0	0.5	left side
SIDE CHANNEL	2766.3		in on left
SIDE CHANNEL	2778.5		out on left, old SCH
FORD	3349.6		plastic webbing for bed 2 m wide
TRIBUTARY	3440.7	3.5	right side, sig. flow moss creek 19°C
TRIBUTARY	3872.8	0.3	left, barely trickle
TRIBUTARY	3947.7	0.2	right side
TRAIL CROSSING	4061.0		pvt. Dirt road fords stream
SIDE CHANNEL	4159.1	4.0	in on right
SIDE CHANNEL	4214.9		out on right
TRIBUTARY	4239.0	0.4	left side, little flow
SIDE CHANNEL	4439.7		left side, little flow (in)
SIDE CHANNEL	4465.7		out on left at LJ/DJ
TRIBUTARY	4465.7		left side
TRIBUTARY	4572.1	3.5	in on left, large flow
SIDE CHANNEL	4673.1		in on left - goes around large island
SIDE CHANNEL	4703.7		out on left - heavily silted 4-3
TRAIL	4853.3		in on left
SIDE CHANNEL	5803.3	3.0	in on right - shift in length
SIDE CHANNEL	5827.6		out on right
TRIBUTARY	5882.7	0.3	right side, little flow
TRIBUTARY	5908.1	0.3	right side, little flow, 18°C
TRIBUTARY	6092.5		right side
DAM	6093.6		Dry dam, water flows through pipe on right side, diameter 80 cm, 250 m wide
TRIBUTARY	6164.7		start above beaver pond, heavy siltation; left side: beaver dam starts right above trib; 17°C
SIDE CHANNEL	6723.2		in on right
SIDE CHANNEL	6997.4		in on right Island really
SIDE CHANNEL	7019.5		out on right
TRIBUTARY	7229.2	0.3	left side, 18°C, seep @ 7242.2 left
TRIBUTARY	7500.6	0.3	right side, little flow, 18°C
RUN	7625.2	7.0	
TRIBUTARY	7632.4	0.4	right side, little flow, 18°C
TRIBUTARY	7745.3	0.2	left side, 18°C
TRIBUTARY	7858.0	0.3	right side
TRIBUTARY	8028.6		right side 18°C
SIDE CHANNEL	8251.0		left side IN

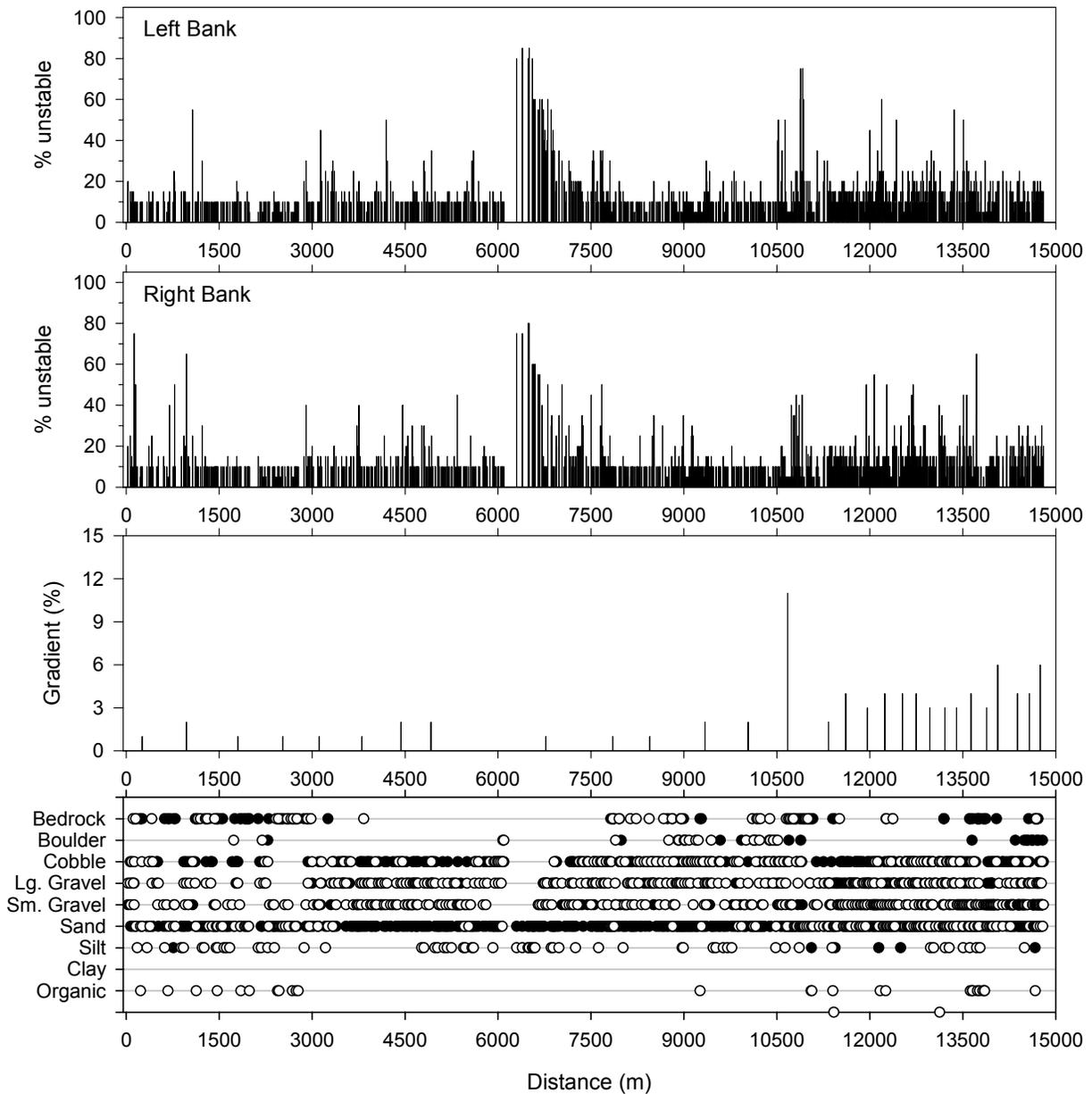
SIDE CHANNEL	8311.6		out on left
TRIBUTARY	8662.4	1.2	right side, decent flow, 17.5°C
TRIBUTARY	8756.5	3.0	right side, big flow, 19°C
TRAIL CROSSING	8766.5		road crossing
TRIBUTARY	10231.3	0.2	1 ft. side
TRIBUTARY	10298.0	0.5	left
SIDE CHANNEL	10479.7		in on right.
SIDE CHANNEL	10549.9		out on right
TRIBUTARY	10911.9	0.2	Left side
SEEP	10921.9		Left side
TRIBUTARY	11184.4	1.7	Right
TRIBUTARY	11478.7	0.3	Right
TRIBUTARY	11721.6	0.8	Left
TRIBUTARY	12311.0	0.8	Left
TRIBUTARY	12557.0	2.5	Right
TRIBUTARY	12954.4	0.3	Left
TRIBUTARY	13031.6	4.3	Right
TRIBUTARY	13220.8	0.3	Left
TRIBUTARY	13451.2	1.0	Left, 1/4 flow
TRIBUTARY	13627.5	0.5	Right
TRIBUTARY	14072.7	1.5	Right
TRIBUTARY	14303.9	0.8	Left
TRIBUTARY	14632.5	0.5	Left
TRIBUTARY	14700.4	0.5	Left
TRIBUTARY	14759.8	1.4	Left



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Jones Creek (entire), summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Lance Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Jones Creek (entire), summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Lance Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Stream:	Jones Creek, section 1
District:	Toccoa
USGS Quadrangle:	Campbell Mountain/Nimblewill
Survey Date:	07/16/01
Downstream Starting Point:	Confluence with Etowah River
Total Distance Surveyed (km):	2.7

	Pools	Riffles
Percent of Total Stream Area:	78	22
Number:	79	37
Number per km:	29	14
Total Area (m ²):	20596±1508	5866±1025
Mean Area (m ²):	261	159
Correction Factor:	1.13	1.14
# of Paired Samples:	8	4
Mean Maximum Depth (cm):	77	49
Mean Average Depth (cm):	45	20
Mean Residual Pool Depth (cm):	28	--
% of Pool Habitat Surveyed as Glides:	8	--
% of Riffle Habitat Surveyed as Runs:	--	0
% of Riffle Habitat Surveyed as Cascades:	--	8
> 35% Embeddedness (%):	94	0

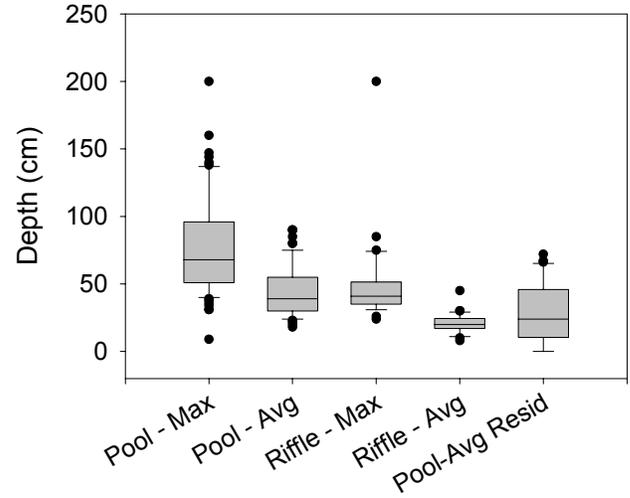
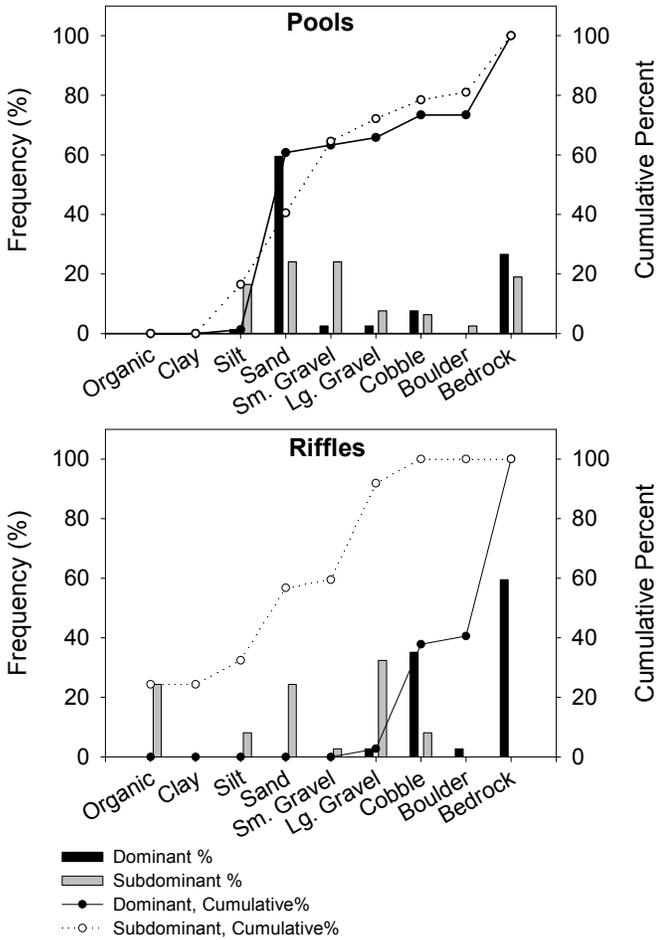
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	21
< 5 m long, 11-50 cm diameter:	6
< 5 m long, >50 cm diameter:	0
> 5 m long, 5 cm – 10 cm diameter:	24
> 5 m long, 11-50 cm diameter:	17
> 5 m long, >50 cm diameter:	14
Rootwads:	6
Total:	88

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	40	14
Maximum	46	34
75 th Percentile	43	16
25 th Percentile	38	9
Minimum	30	2

*Left riparian, right riparian, and bankfull channel widths were added together for calculations

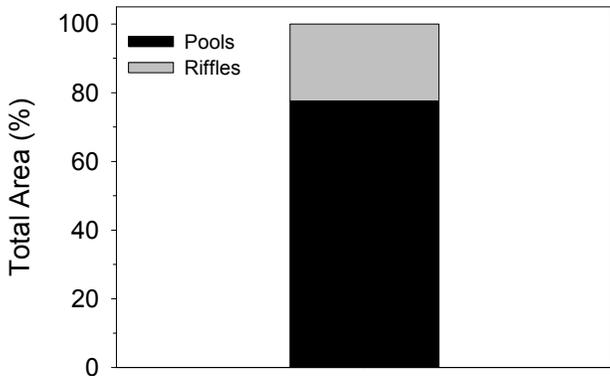
**Left and right riparian widths were grouped (not added) together for calculations

Other Stream Attributes	
Mean Bankfull Channel Width (m):	12
Mean Channel Gradient (%):	1

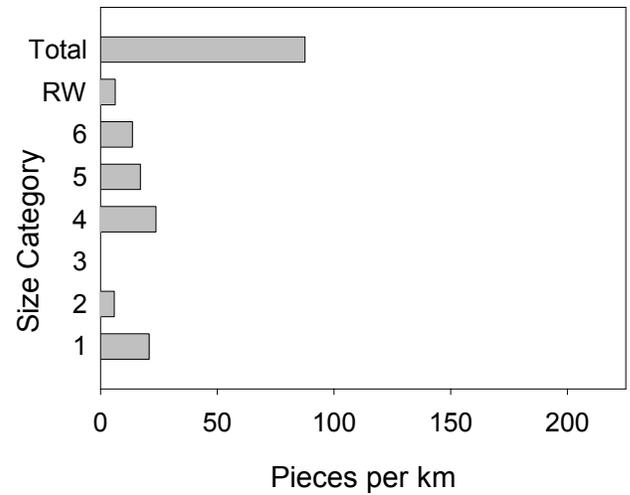


Maximum and average depths and residual pool depths for pools and riffles in Jones Creek, section 1, summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.

Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Jones Creek, section 1, summer 2001.



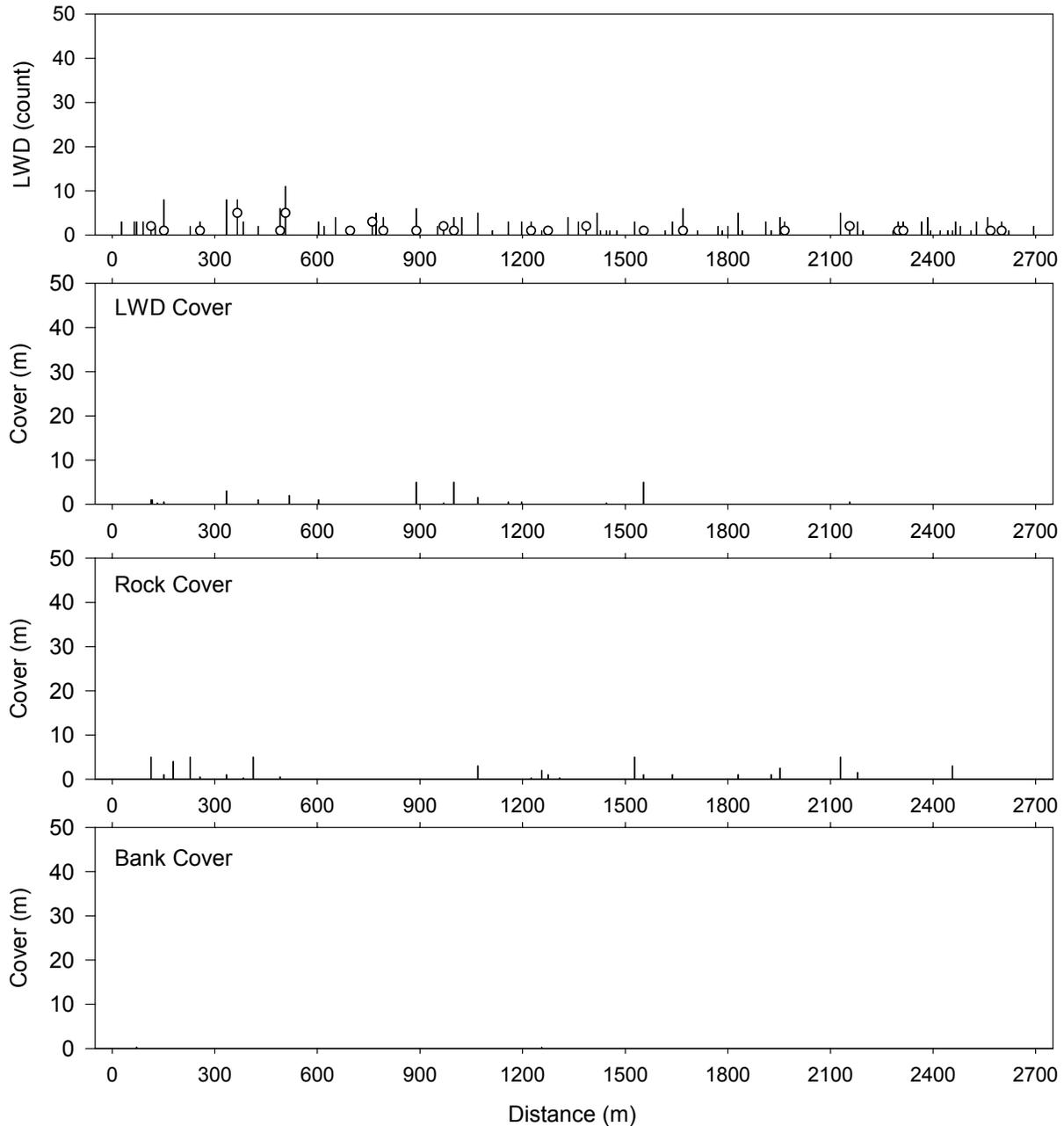
Estimated area of Jones Creek, section 1 in pools and riffles as calculated using BVET techniques, summer 2001.



LWD per kilometer in Jones Creek section 1, summer 2001.

Stream features found on Jones Creek, section 1 during BVET habitat survey, summer 2001. Distance is meters from confluence with Lance Creek.

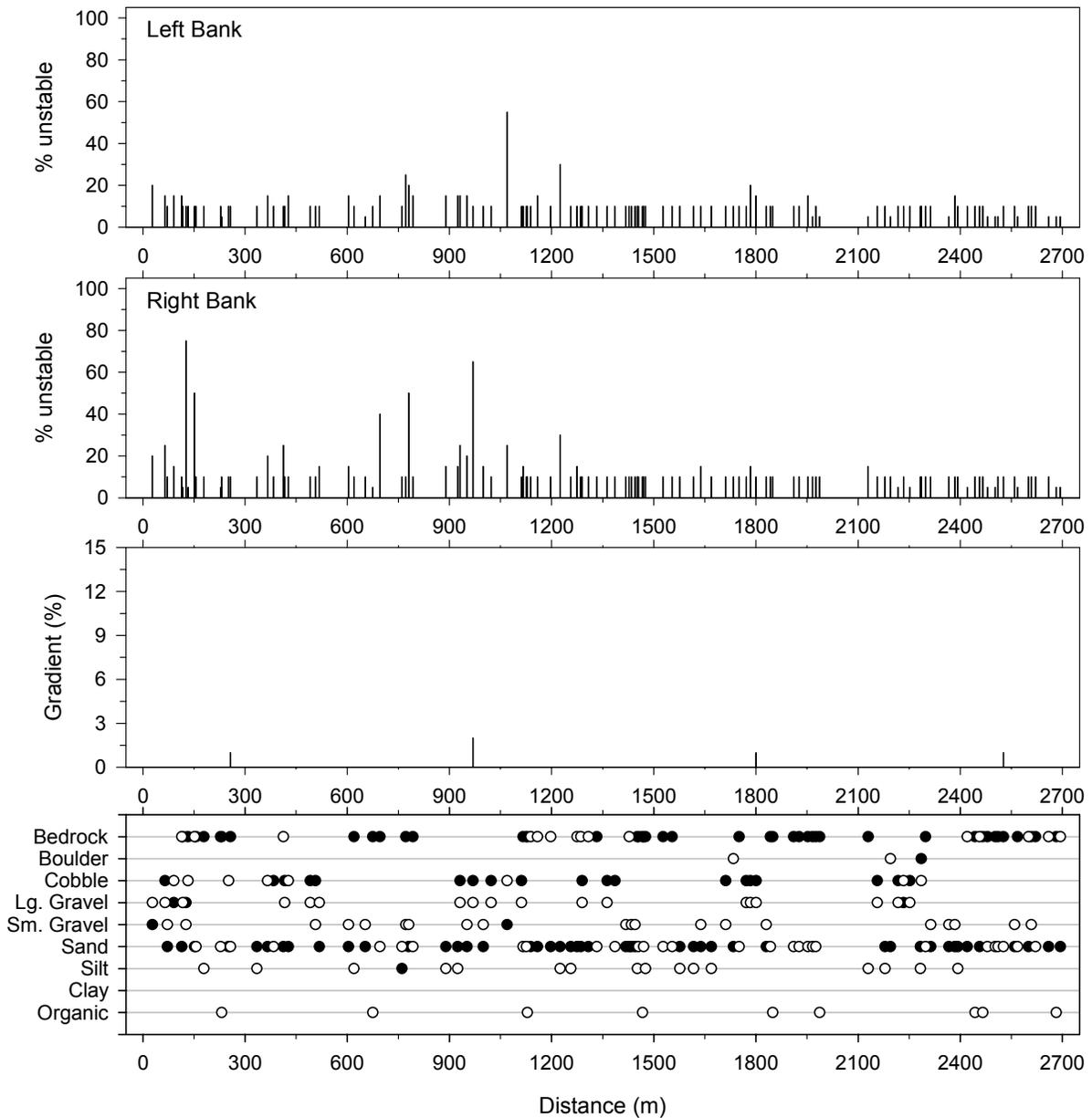
Stream Feature	Distance (m)	Width (m)	Comments
SEEP	254.5	0.5	clean-cold
TRIBUTARY	324.8	0.3	right side, 0.3 little flow
TRIBUTARY	352.7		
SEEP	412.5		left side
TRIBUTARY	583.0	1.5	right side, good flow
TRIBUTARY	1289.4	0.3	left side, little flow
TRIBUTARY	1796.2	0.5	
TRIBUTARY	2412.0	1.0	left side, little flow
RUN	2634.4	4.0	deep, fast chute (run)
FALL	2694.0		4 m high



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Jones Creek, section 1, summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Lance Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Jones Creek, section 1, summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Lance Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Stream:	Jones Creek, section 2
District:	Toccoa
USGS Quadrangle:	Campbell Mountain/Nimblewill
Survey Date:	07/16/01
Downstream Starting Point:	Waterfall at 2.7 km
Total Distance Surveyed (km):	3.4

	Pools	Riffles
Percent of Total Stream Area:	74	26
Number:	94	53
Number per km:	28	16
Total Area (m ²):	17529±2386	6174±671
Mean Area (m ²):	186	116
Correction Factor:	0.96	1.02
# of Paired Samples:	8	5
Mean Maximum Depth (cm):	60	31
Mean Average Depth (cm):	35	18
Mean Residual Pool Depth (cm):	18	--
% of Pool Habitat Surveyed as Glides:	9	--
% of Riffle Habitat Surveyed as Runs:	--	0
% of Riffle Habitat Surveyed as Cascades:	--	0
> 35% Embeddedness (%):	84	2

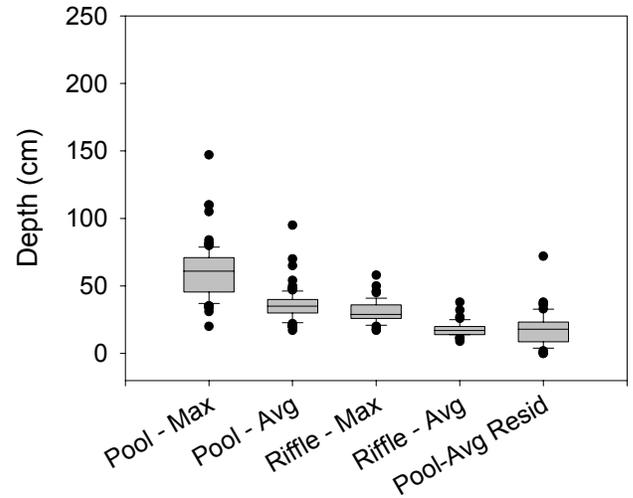
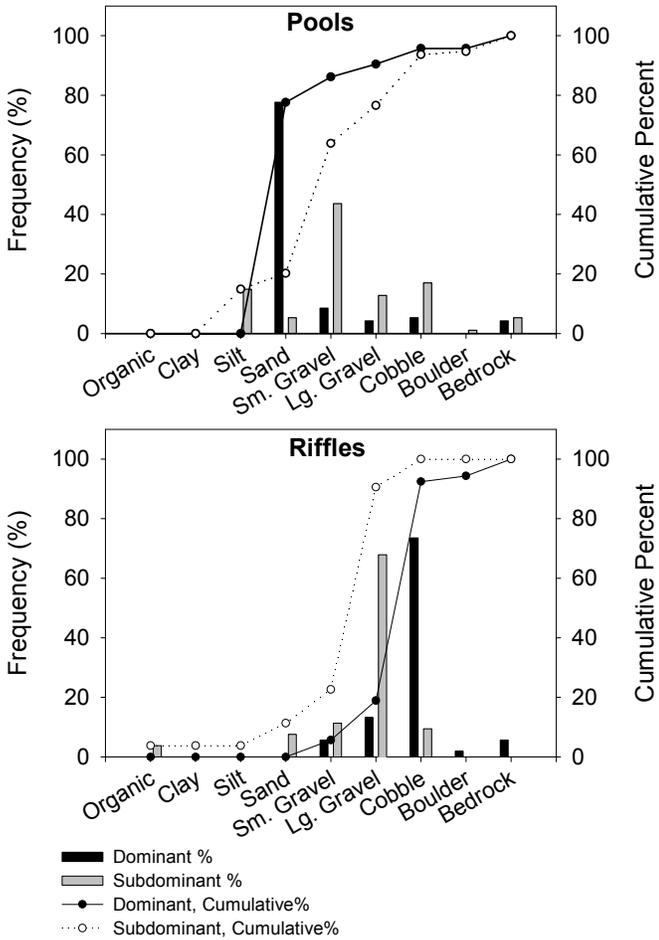
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	24
< 5 m long, 11-50 cm diameter:	4
< 5 m long, >50 cm diameter:	0
> 5 m long, 5 cm – 10 cm diameter:	29
> 5 m long, 11-50 cm diameter:	8
> 5 m long, >50 cm diameter:	1
Rootwads:	4
Total:	71

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	106	48
Maximum	143	130
75 th Percentile	126	59
25 th Percentile	99	9
Minimum	36	5

*Left riparian, right riparian, and bankfull channel widths were added together for calculations

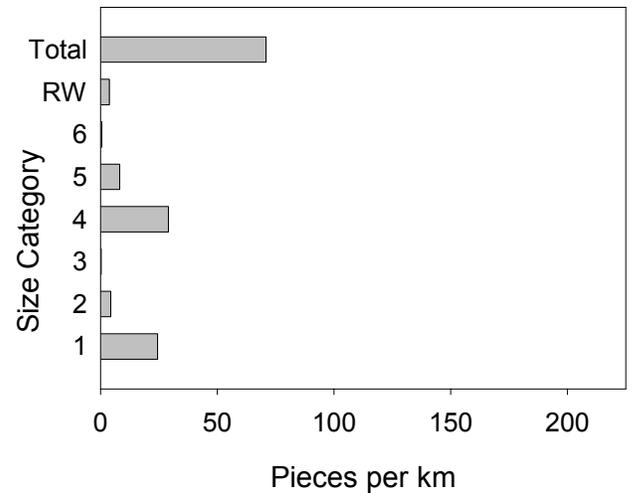
**Left and right riparian widths were grouped (not added) together for calculations

Other Stream Attributes	
Mean Bankfull Channel Width (m):	10
Mean Channel Gradient (%):	2

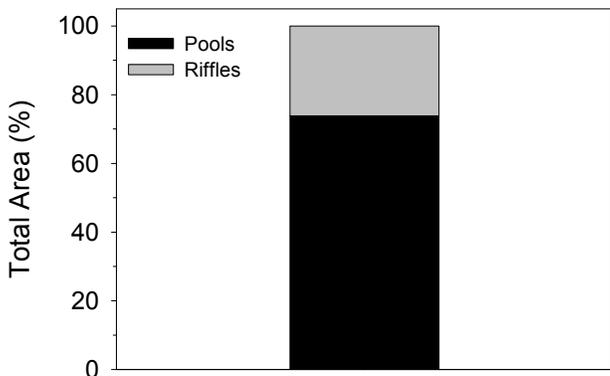


Maximum and average depths and residual pool depths for pools and riffles in Jones Creek, section 2, summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.

Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Jones Creek, section 2, summer 2001.



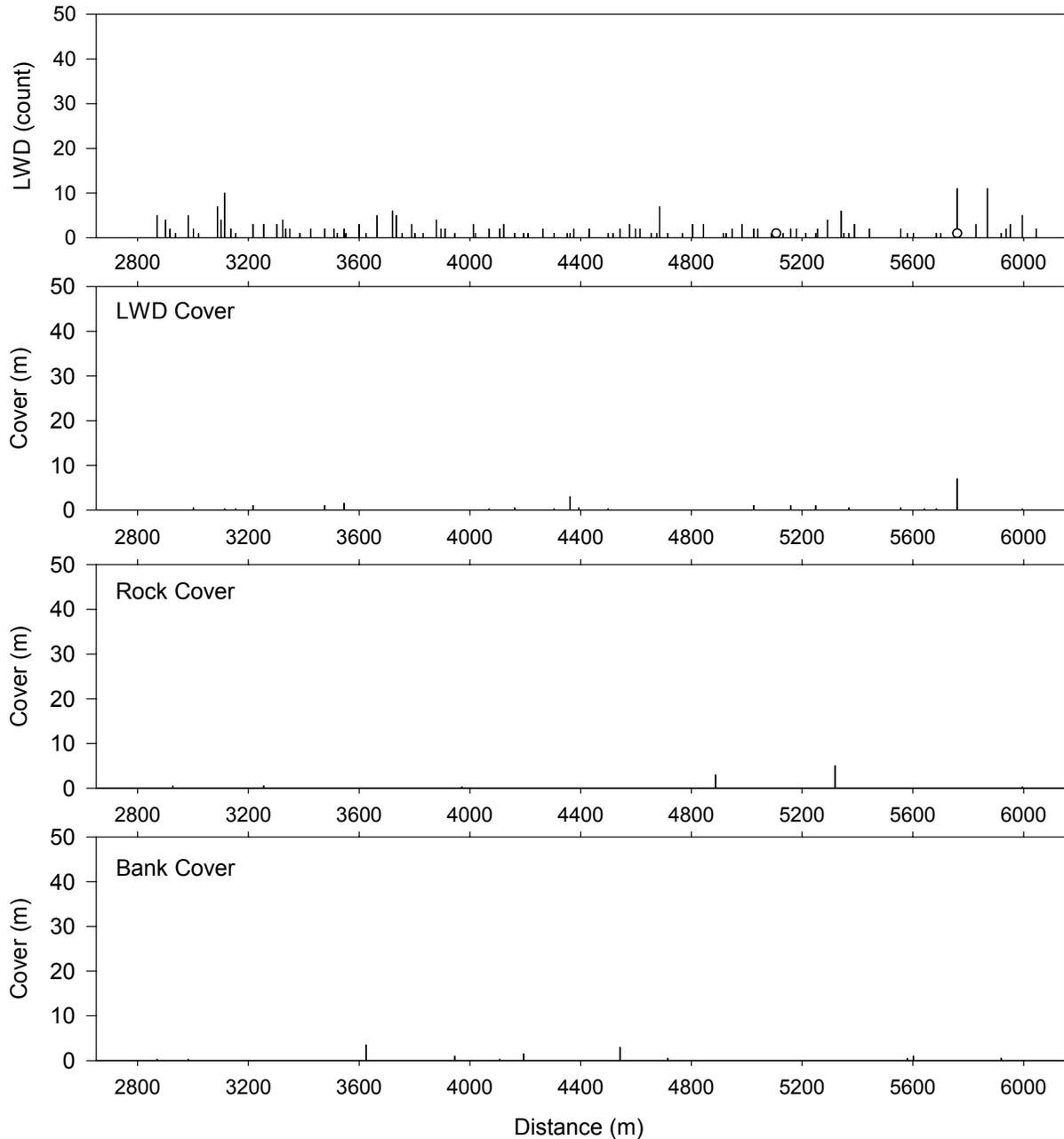
LWD per kilometer in Jones Creek section 2, summer 2001.



Estimated area of Jones Creek, section 2 in pools and riffles as calculated using BVET techniques, summer 2001.

Stream features found on Jones Creek, section 2 during BVET habitat survey, summer 2001. Distance is meters from confluence with Lance Creek.

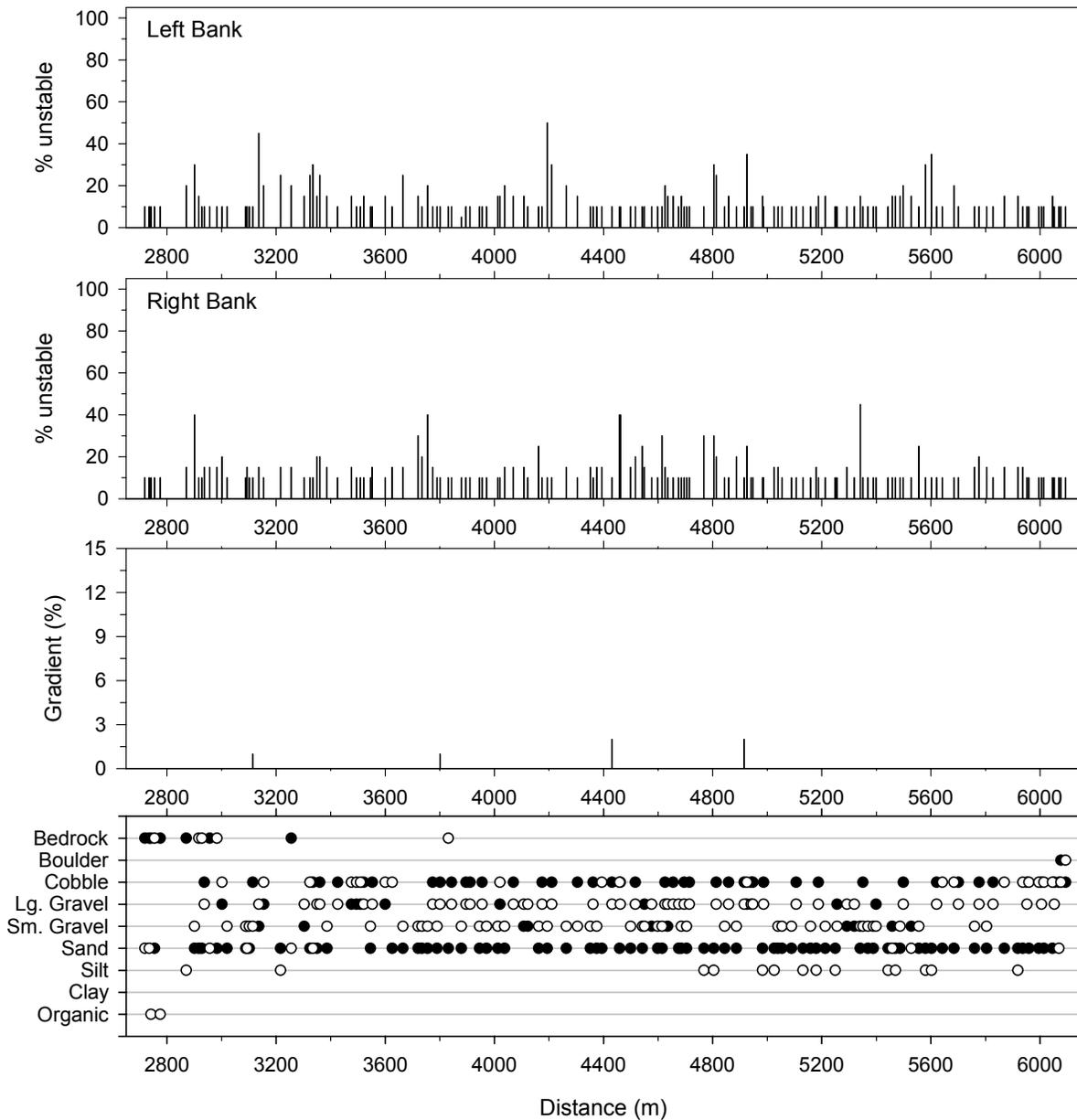
Stream Feature	Distance (m)	Width (m)	Comments
FALL	2694.0		4 m high
TRIBUTARY	2749.0	0.5	left side
SIDE CHANNEL	2766.3		in on left
SIDE CHANNEL	2778.5		out on left, old SCH
FORD	3349.6		plastic webbing for bed 2 m wide
TRIBUTARY	3440.7	3.5	right side, sig. flow moss creek 19°C
TRIBUTARY	3872.8	0.3	left, barely trickle
TRIBUTARY	3947.7	0.2	right side
TRAIL CROSSING	4061.0		pvt. Dirt road fords stream
SIDE CHANNEL	4159.1	4.0	in on right
SIDE CHANNEL	4214.9		out on right
TRIBUTARY	4239.0	0.4	left side, little flow
SIDE CHANNEL	4439.7		left side, little flow (in)
SIDE CHANNEL	4465.7		out on left at LJ/DJ
TRIBUTARY	4465.7		left side
TRIBUTARY	4572.1	3.5	in on left, large flow
SIDE CHANNEL	4673.1		in on left - goes around large island
SIDE CHANNEL	4703.7		out on left - heavily silted 4-3
TRAIL	4853.3		in on left
SIDE CHANNEL	5803.3	3.0	in on right - shift in length
SIDE CHANNEL	5827.6		out on right
TRIBUTARY	5882.7	0.3	right side, little flow
TRIBUTARY	5908.1	0.3	right side, little flow, 18°C
TRIBUTARY	6092.5		right side
DAM	6093.6		Dry dam, water flows through pipe on right side, diameter 80 cm, 250 m wide



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Jones Creek, section 2, summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Lance Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Jones Creek, section 2, summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Lance Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Stream:	Jones Creek, section 3
District:	Toccoa
USGS Quadrangle:	Campbell Mountain/Nimblewill
Survey Date:	07/16/01
Downstream Starting Point:	Dry dam at 6.1 km
Total Distance Surveyed (km):	4.6

	Pools	Riffles
Percent of Total Stream Area:	66	34
Number:	152	73
Number per km:	33	16
Total Area (m ²):	22552±1832	11416±952
Mean Area (m ²):	148	156
Correction Factor:	0.97	1.21
# of Paired Samples:	15	6
Mean Maximum Depth (cm):	64	36
Mean Average Depth (cm):	39	21
Mean Residual Pool Depth (cm):	18	--
% of Pool Habitat Surveyed as Glides:	1	--
% of Riffle Habitat Surveyed as Runs:	--	0
% of Riffle Habitat Surveyed as Cascades:	--	1
> 35% Embeddedness (%):	65	4

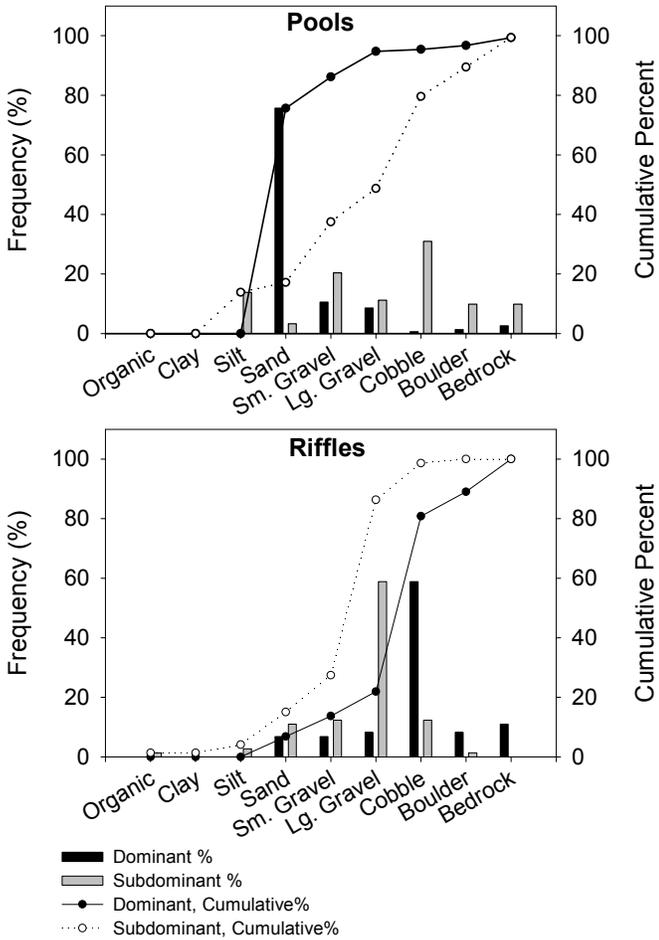
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	12
< 5 m long, 11-50 cm diameter:	2
< 5 m long, >50 cm diameter:	0
> 5 m long, 5 cm – 10 cm diameter:	10
> 5 m long, 11-50 cm diameter:	3
> 5 m long, >50 cm diameter:	1
Rootwads:	8
Total:	36

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	76	33
Maximum	217	150
75 th Percentile	104	47
25 th Percentile	27	9
Minimum	24	4

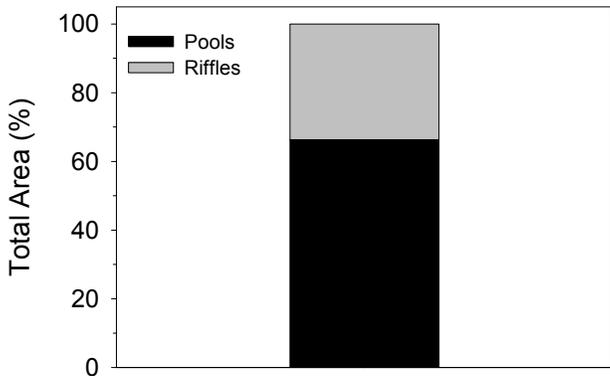
*Left riparian, right riparian, and bankfull channel widths were added together for calculations

**Left and right riparian widths were grouped (not added) together for calculations

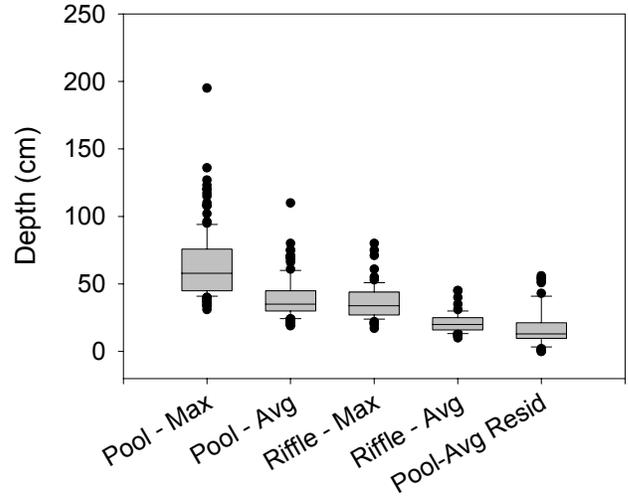
Other Stream Attributes	
Mean Bankfull Channel Width (m):	10
Mean Channel Gradient (%):	1



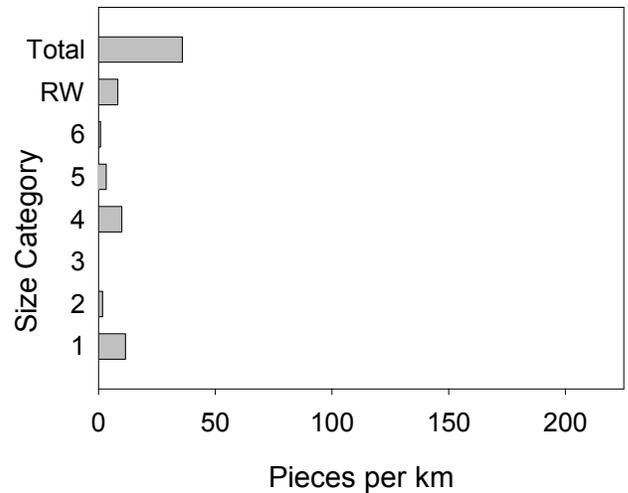
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Jones Creek, section 3, summer 2001.



Estimated area of Jones Creek, section 3 in pools and riffles as calculated using BVET techniques, summer 2001.



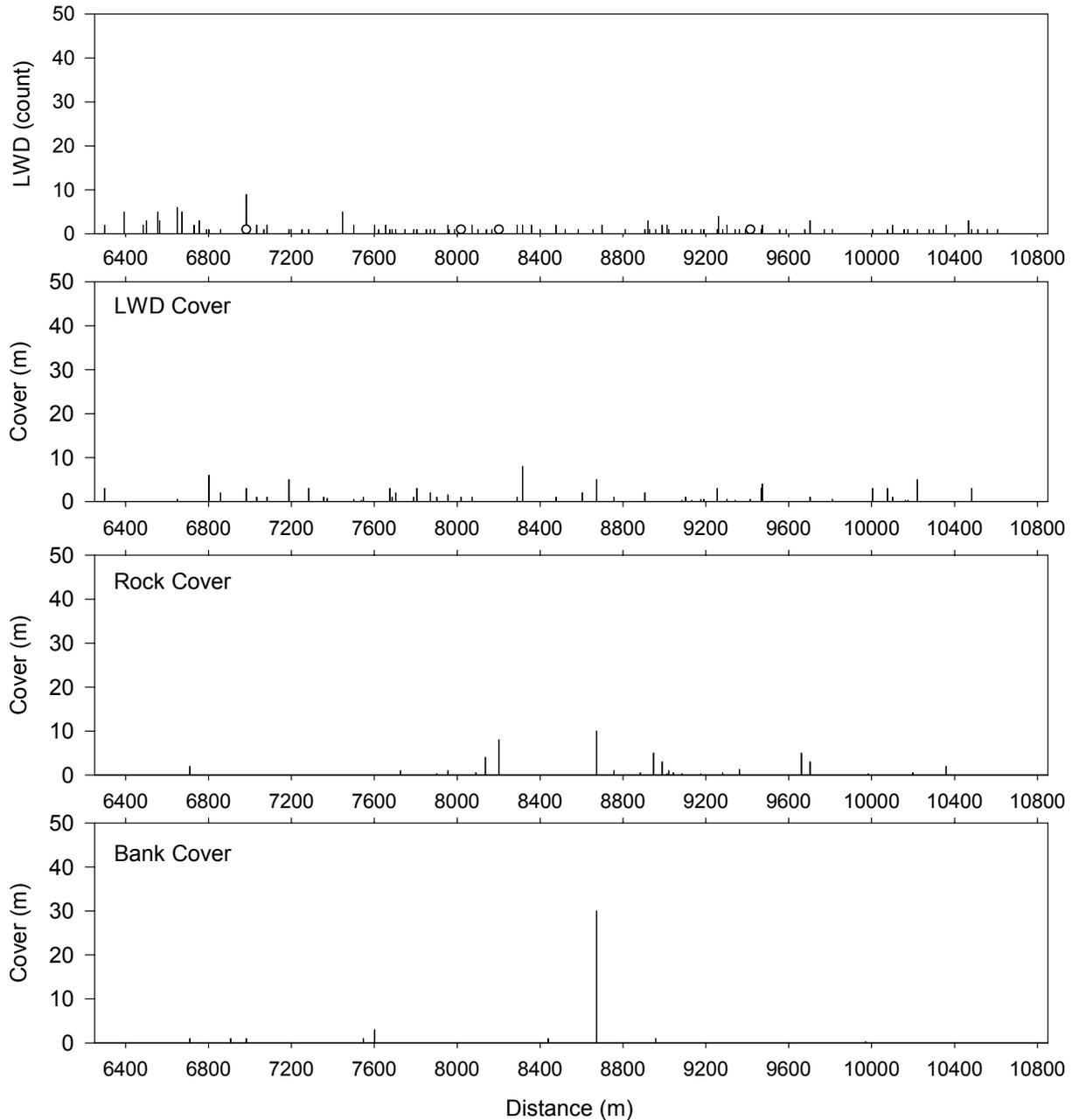
Maximum and average depths and residual pool depths for pools and riffles in Jones Creek, section 3, summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



LWD per kilometer in Jones Creek section 3, summer 2001.

Stream features found on Jones Creek, section 3 during BVET habitat survey, summer 2001. Distance is meters from confluence with Lance Creek.

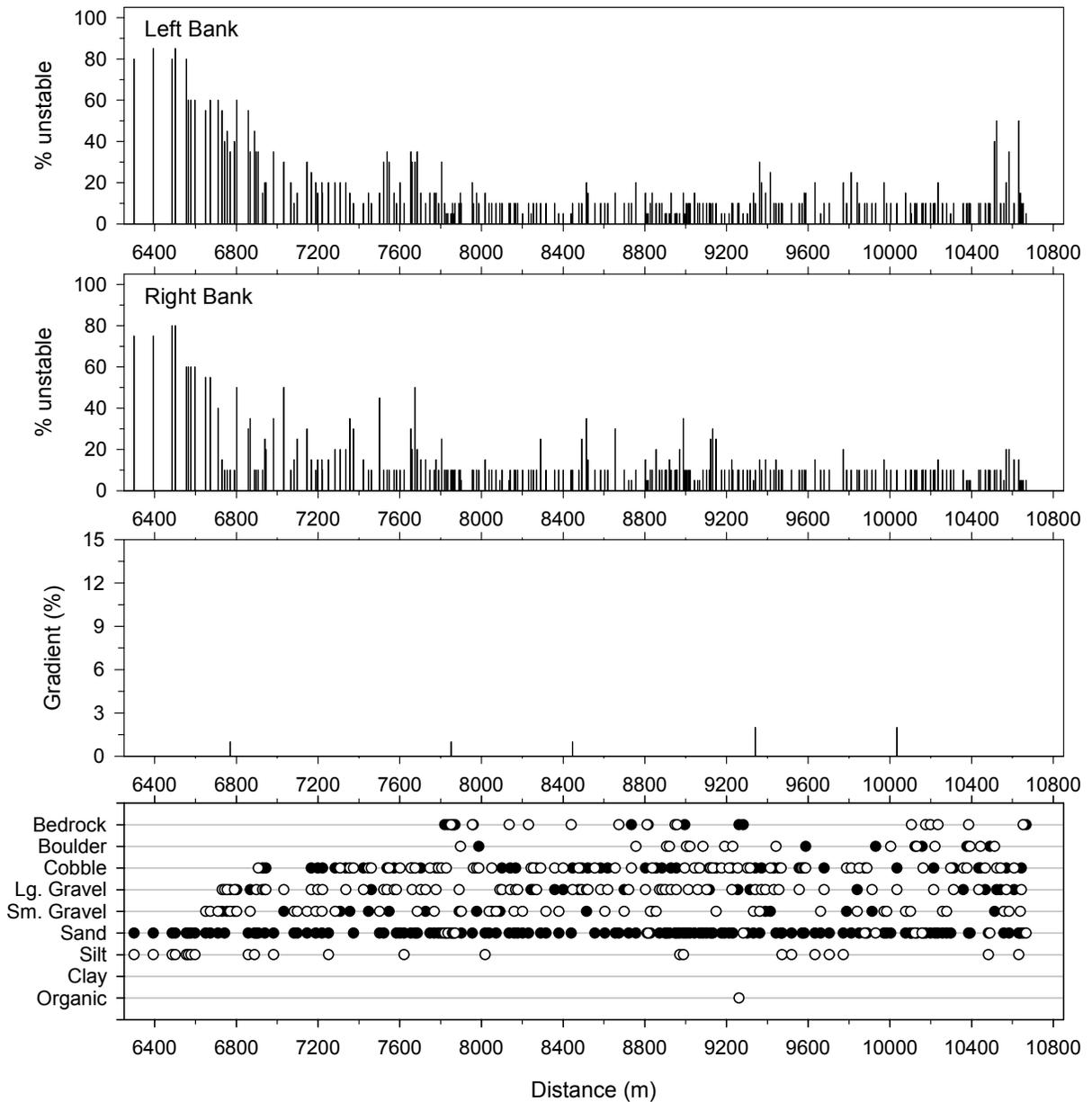
Stream Feature	Distance (m)	Width (m)	Comments
DAM	6093.6		Dry dam, water flows through pipe on right side, diameter 80 cm, 250 m wide
TRIBUTARY	6164.7		start above beaver pond, heavy siltation; left side: beaver dam starts right above trib; 17°C
SIDE CHANNEL	6723.2		in on right
SIDE CHANNEL	6997.4		in on right Island really
SIDE CHANNEL	7019.5		out on right
TRIBUTARY	7229.2	0.3	left side, 18°C, seep @ 7242.2 left
TRIBUTARY	7500.6	0.3	right side, little flow, 18°C
RUN	7625.2	7.0	
TRIBUTARY	7632.4	0.4	right side, little flow, 18°C
TRIBUTARY	7745.3	0.2	left side, 18°C
TRIBUTARY	7858.0	0.3	right side
TRIBUTARY	8028.6		right side 18°C
SIDE CHANNEL	8251.0		left side IN
SIDE CHANNEL	8311.6		out on left
TRIBUTARY	8662.4	1.2	right side, decent flow, 17.5°C
TRIBUTARY	8756.5	3.0	right side, big flow, 19°C
TRAIL CROSSING	8766.5		road crossing
TRIBUTARY	10231.3	0.2	1 ft. side
TRIBUTARY	10298.0	0.5	left
SIDE CHANNEL	10479.7		in on right.
SIDE CHANNEL	10549.9		out on right



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Jones Creek, section 3, summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Lance Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Jones Creek, section 3, summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Lance Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Stream:	Jones Creek, section 4
District:	Toccoa
USGS Quadrangle:	Campbell Mountain/Nimblewill
Survey Date:	07/16/01
Downstream Starting Point:	High gradient riffle at 10.7 km
Total Distance Surveyed (km):	4.1

	Pools	Riffles
Percent of Total Stream Area:	52	48
Number:	249	157
Number per km:	60	38
Total Area (m ²):	8999±275	8152±250
Mean Area (m ²):	36	52
Correction Factor:	1.02	1.00
# of Paired Samples:	22	16
Mean Maximum Depth (cm):	44	23
Mean Average Depth (cm):	27	12
Mean Residual Pool Depth (cm):	11	--
% of Pool Habitat Surveyed as Glides:	0	--
% of Riffle Habitat Surveyed as Runs:	--	0
% of Riffle Habitat Surveyed as Cascades:	--	6
> 35% Embeddedness (%):	86	48

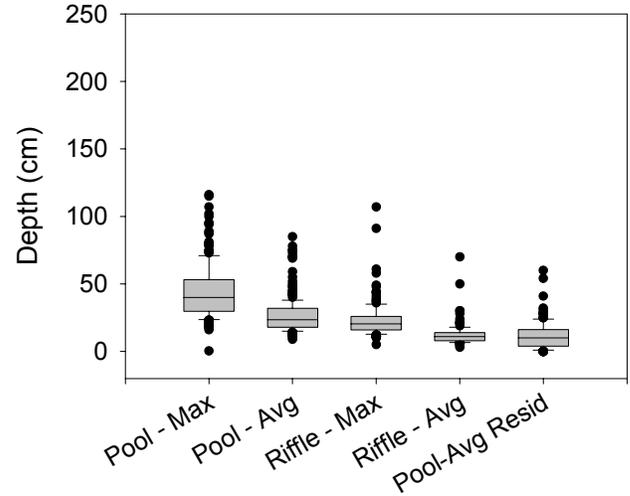
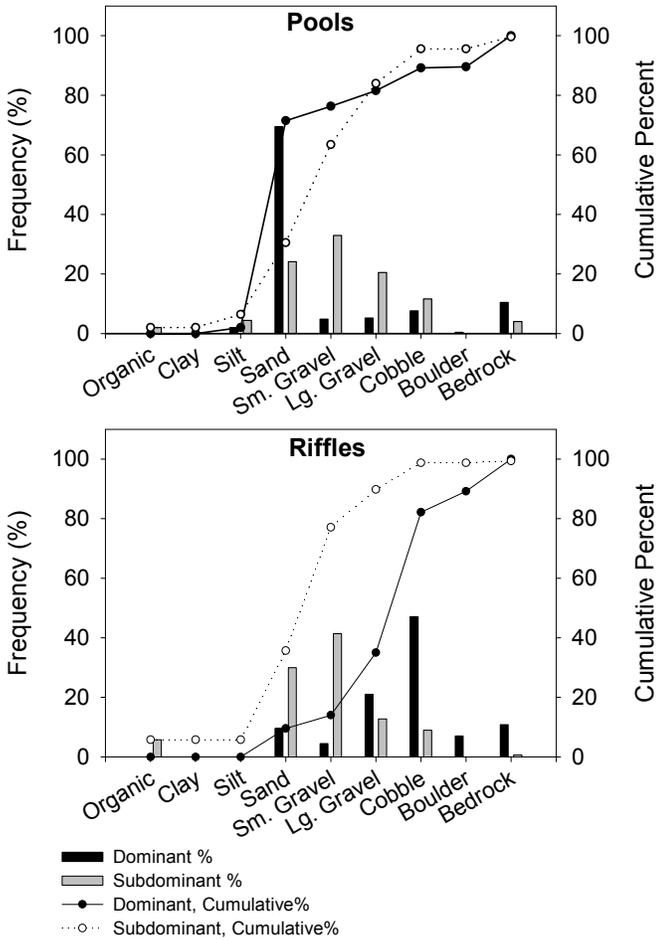
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	75
< 5 m long, 11-50 cm diameter:	79
< 5 m long, >50 cm diameter:	1
> 5 m long, 5 cm – 10 cm diameter:	1
> 5 m long, 11-50 cm diameter:	44
> 5 m long, >50 cm diameter:	3
Rootwads:	6
Total:	208

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	17	6
Maximum	32	14
75 th Percentile	24	10
25 th Percentile	11	2
Minimum	6	0

*Left riparian, right riparian, and bankfull channel widths were added together for calculations

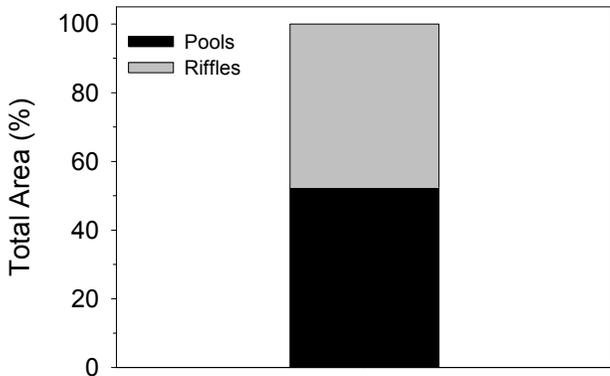
**Left and right riparian widths were grouped (not added) together for calculations

Other Stream Attributes	
Mean Bankfull Channel Width (m):	5
Mean Channel Gradient (%):	4

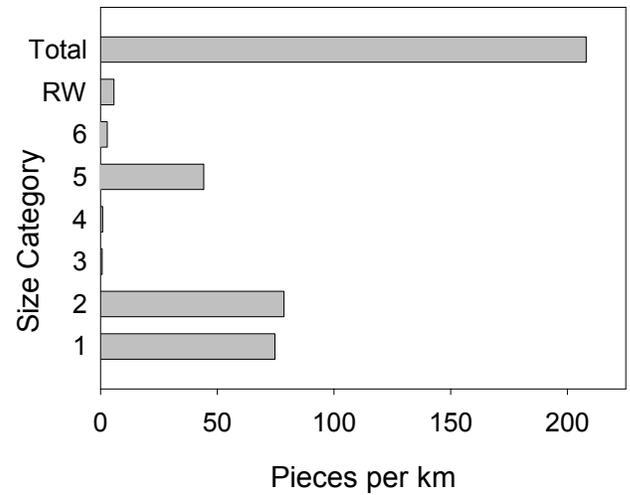


Maximum and average depths and residual pool depths for pools and riffles in Jones Creek, section 4, summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.

Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Jones Creek, section 4, summer 2001.



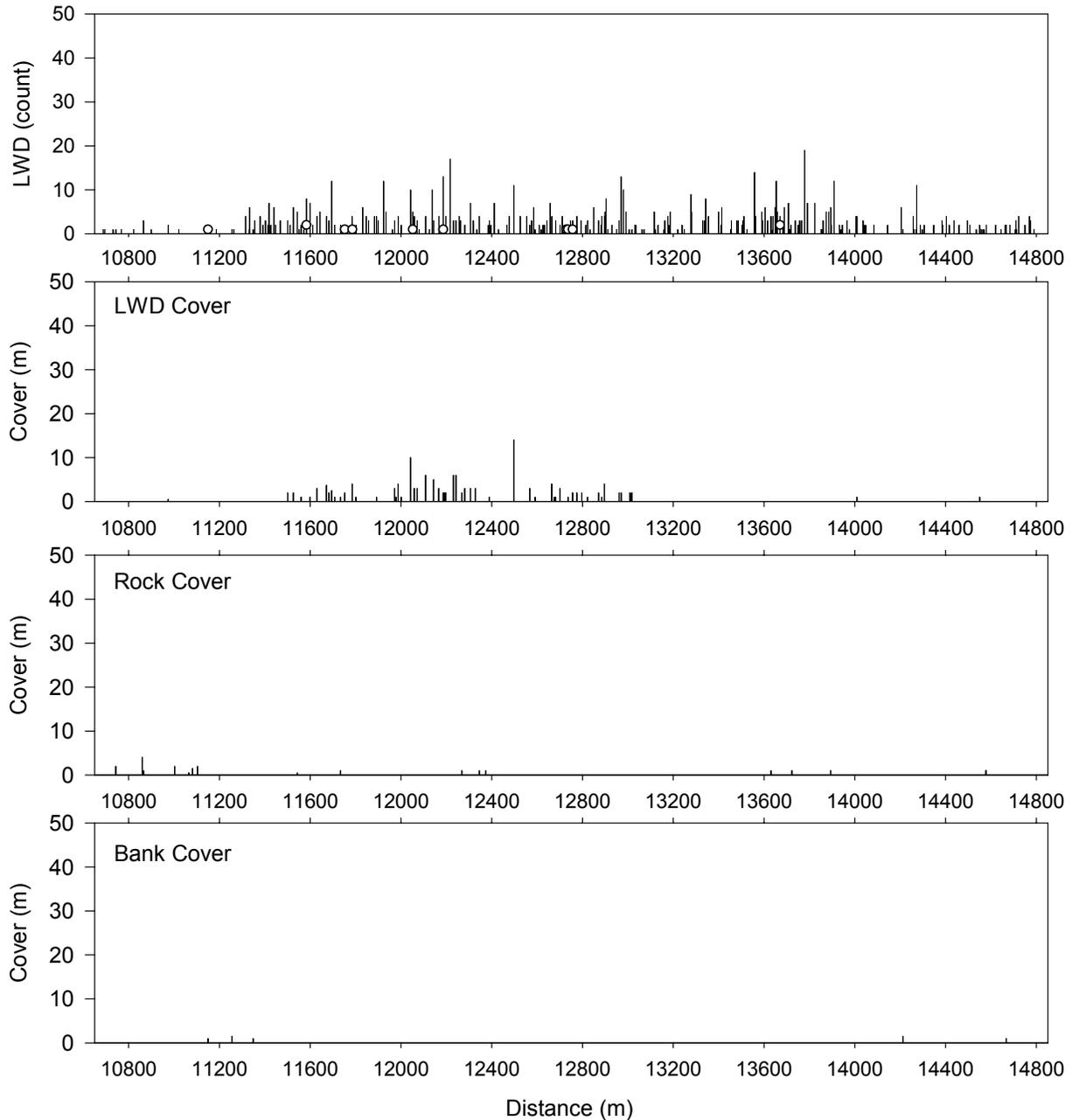
Estimated area of Jones Creek, section 4 in pools and riffles as calculated using BVET techniques, summer 2001.



LWD per kilometer in Jones Creek section 4, summer 2001.

Stream features found on Jones Creek, section 4 during BVET habitat survey, summer 2001. Distance is meters from confluence with Lance Creek.

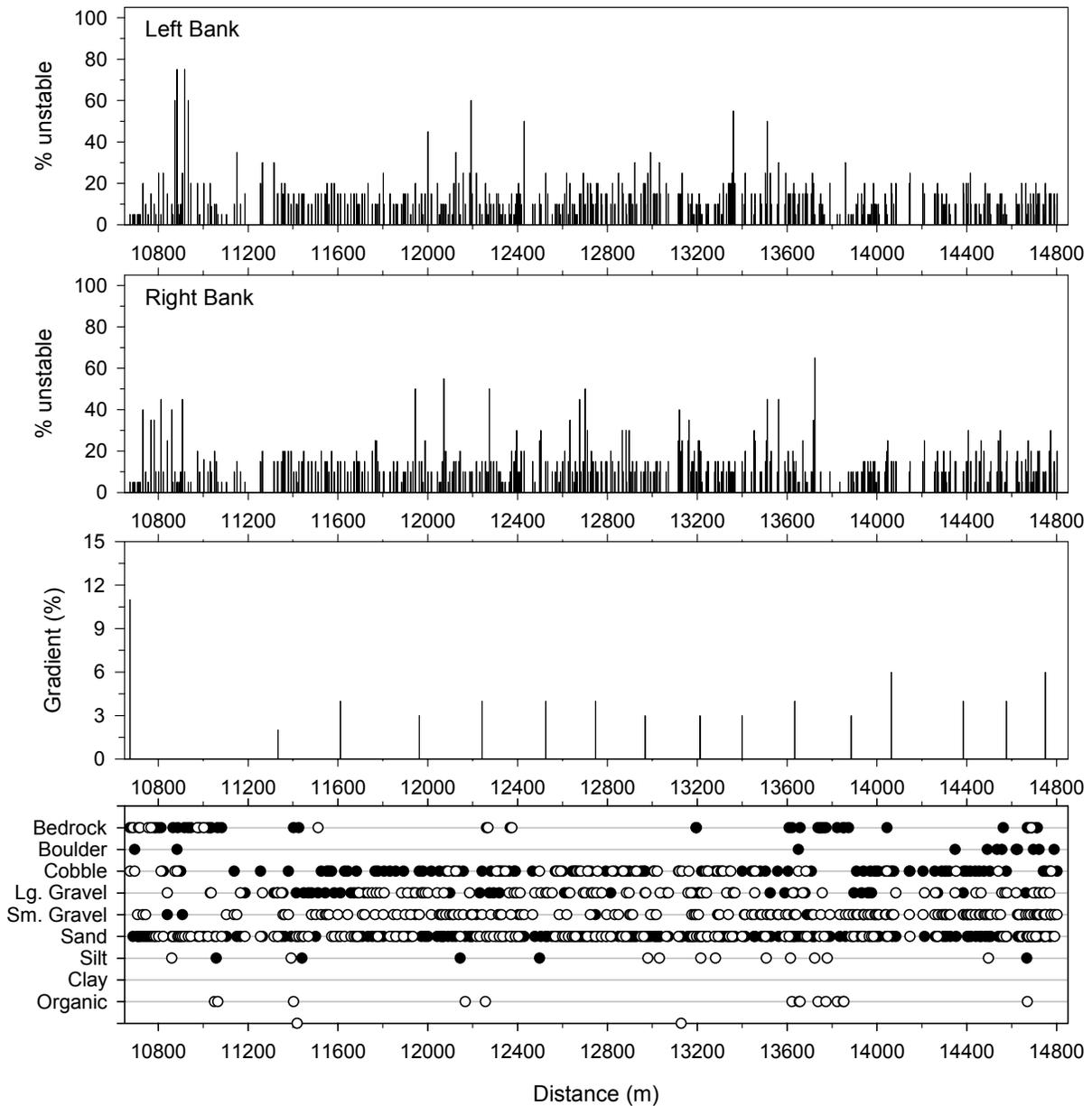
Stream Feature	Distance (m)	Width (m)	Comments
TRIBUTARY	10911.9	0.2	Left side
SEEP	10921.9		Left side
TRIBUTARY	11184.4	1.7	Right
TRIBUTARY	11478.7	0.3	Right
TRIBUTARY	11721.6	0.8	Left
TRIBUTARY	12311.0	0.8	Left
TRIBUTARY	12557.0	2.5	Right
TRIBUTARY	12954.4	0.3	Left
TRIBUTARY	13031.6	4.3	Right
TRIBUTARY	13220.8	0.3	Left
TRIBUTARY	13451.2	1.0	Left, 1/4 flow
TRIBUTARY	13627.5	0.5	Right
TRIBUTARY	14072.7	1.5	Right
TRIBUTARY	14303.9	0.8	Left
TRIBUTARY	14632.5	0.5	Left
TRIBUTARY	14700.4	0.5	Left
TRIBUTARY	14759.8	1.4	Left



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Jones Creek, section 4, summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Lance Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Jones Creek, section 4, summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Lance Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Stream:	Lance Creek
District:	Toccoa
USGS Quadrangle:	Nimblewill
Survey Date:	07/19/2001
Downstream Starting Point:	Confluence with Jones Creek
Total Distance Surveyed (km):	3.5

	Pools	Riffles
Percent of Total Stream Area:	31	69
Number:	140	101
Number per km:	40	29
Total Area (m ²):	4275±85	9563±202
Mean Area (m ²):	31	95
Correction Factor:	1.05	1.04
# of Paired Samples:	10	10
Mean Maximum Depth (cm):	41	23
Mean Average Depth (cm):	27	13
Mean Residual Pool Depth (cm):	13	--
% of Pool Habitat Surveyed as Glides:	0.0	--
% of Riffle Habitat Surveyed as Runs:	--	0.0
% of Riffle Habitat Surveyed as Cascades:	--	5.0
% Pools with > 35% Embeddedness:	98	87

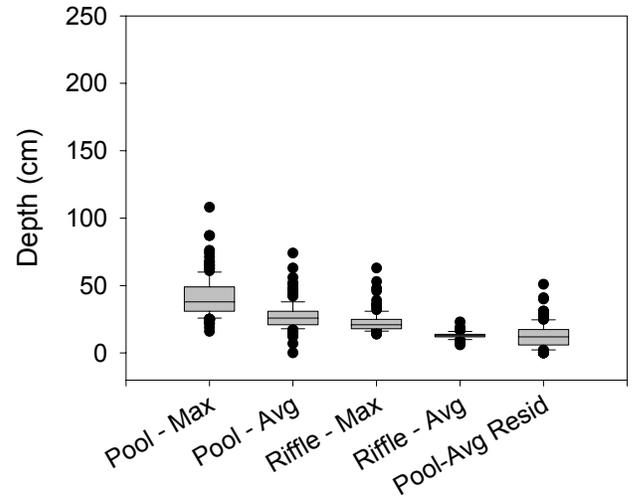
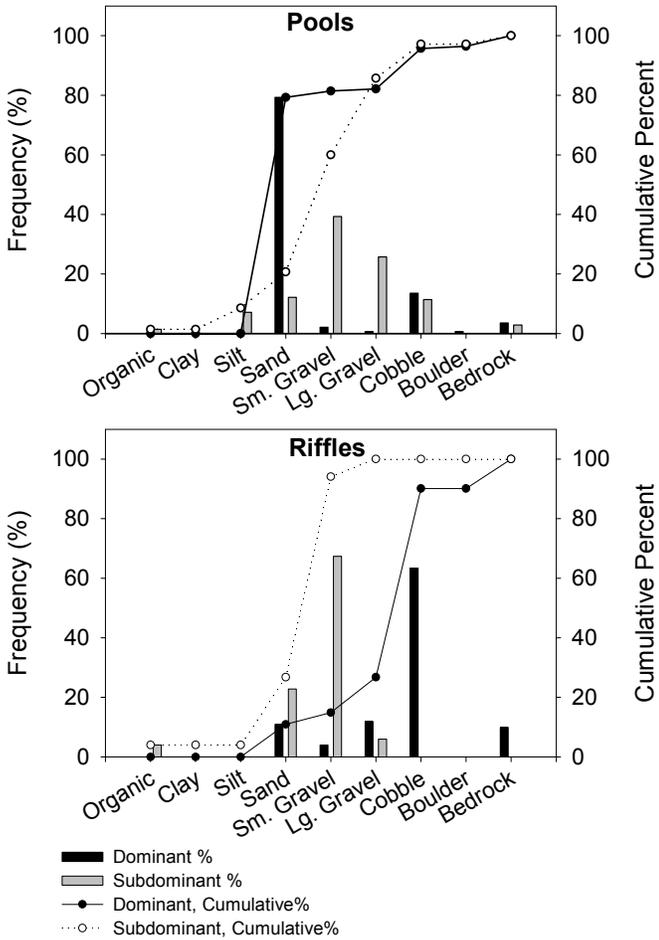
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	30
< 5 m long, 11-50 cm diameter:	61
< 5 m long, >50 cm diameter:	0
> 5 m long, 5 cm – 10 cm diameter:	0
> 5 m long, 11-50 cm diameter:	48
> 5 m long, >50 cm diameter:	2
Rootwads:	5
Total:	146

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	16	5
Maximum	31	13
75 th Percentile	23	9
25 th Percentile	10	2
Minimum	9	0

*Left riparian, right riparian, and bankfull channel widths were added together for calculations

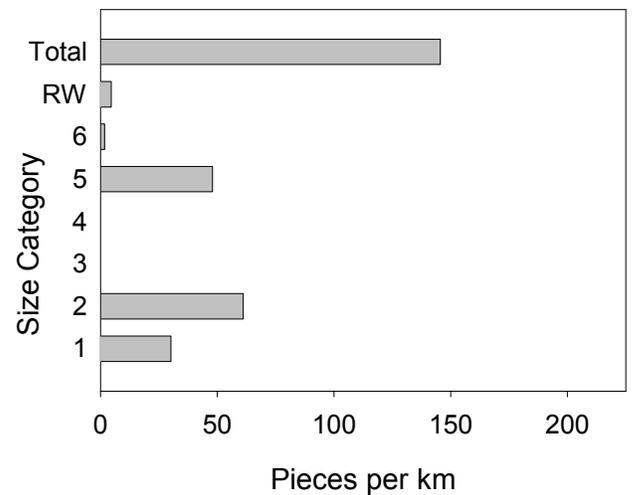
**Left and right riparian widths were grouped (not added) together for calculations

Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	3

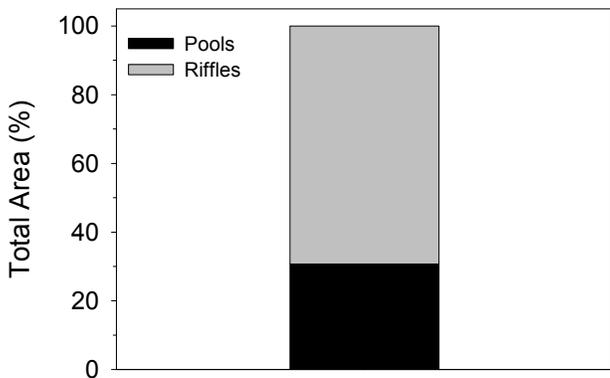


Maximum and average depths and residual pool depths for pools and riffles in Lance Creek, summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.

Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Lance Creek, summer 2001.



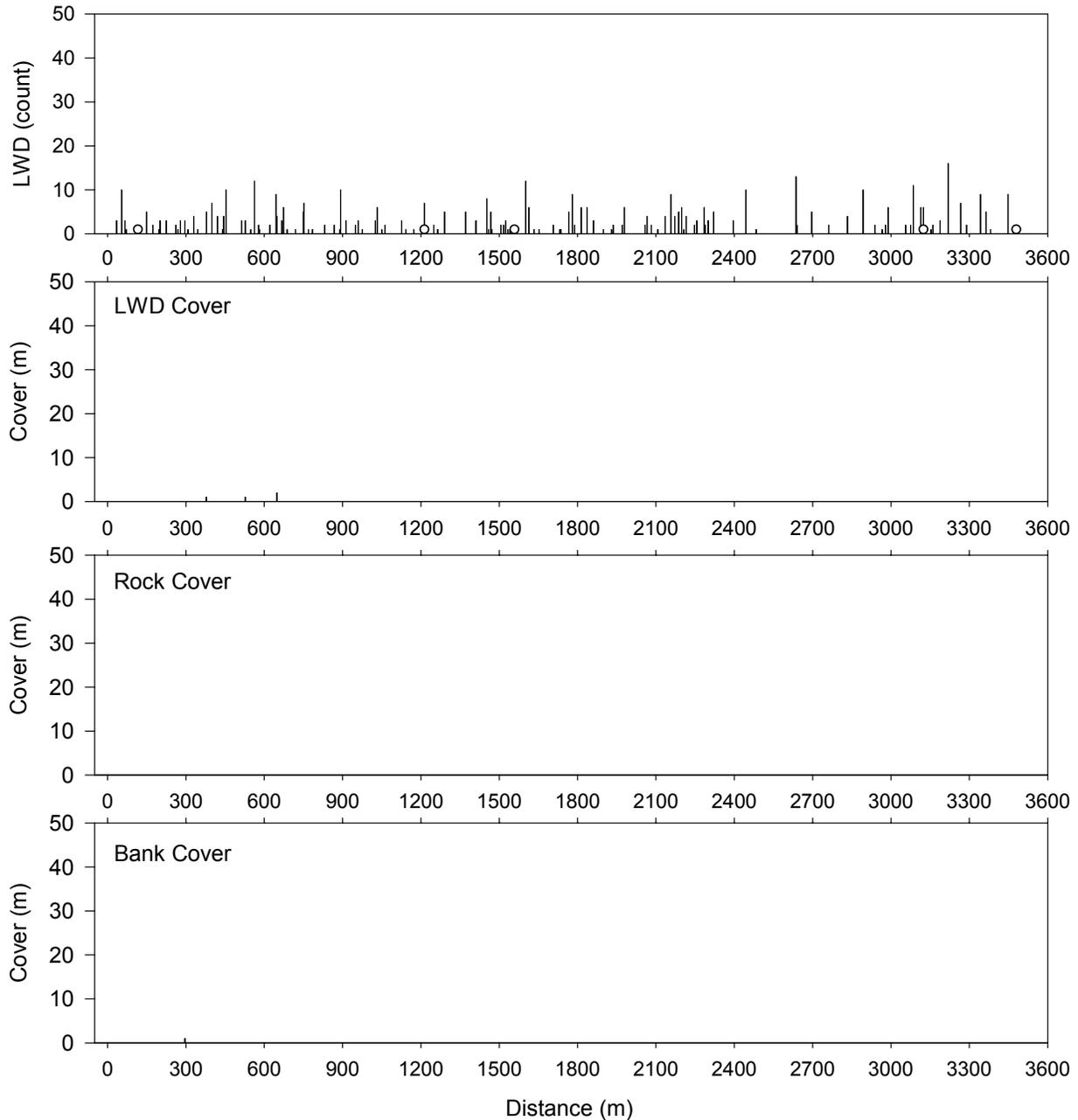
LWD per kilometer in Lance Creek, summer 2001.



Estimated area of Lance Creek in pools and riffles as calculated using BVET techniques, summer 2001.

Stream features found on Lance Creek during BVET habitat survey, summer 2001. Distance is meters from confluence with Jones Creek.

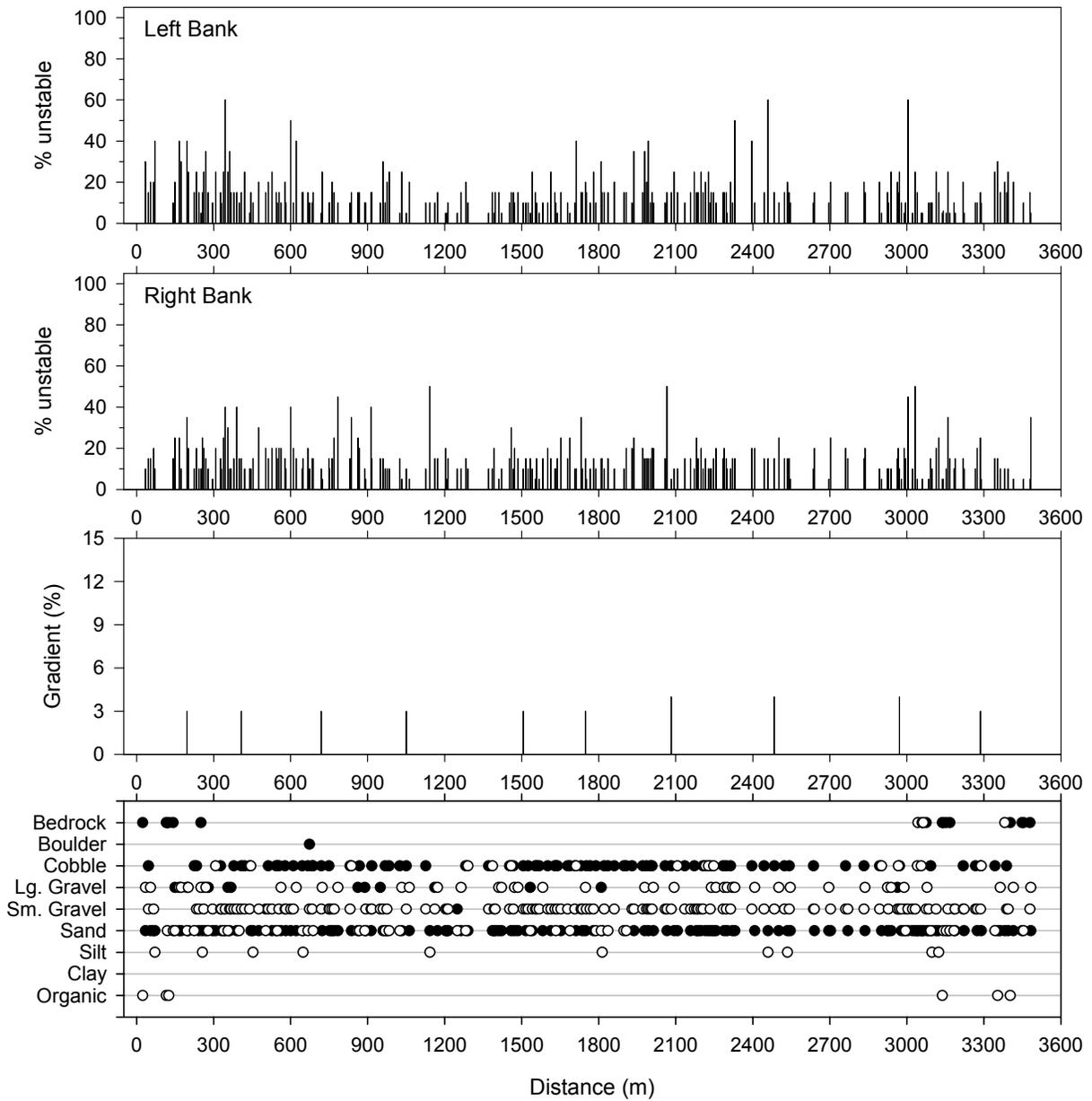
Stream Feature	Distance (m)	Width (m)	Comments
TRIBUTARY	488.8	0.5	Right
TRIBUTARY	859.3	0.8	Left
TRIBUTARY	1112.4	0.3	Right
TRIBUTARY	1249	1.0	
TRIBUTARY	1269	1.0	Left
TRIBUTARY	1475.6	1.0	Left
TRIBUTARY	1898.5	0.3	
TRIBUTARY	1947.9	0.8	Right
TRIBUTARY	2182.9	0.3	Left
TRIBUTARY	2504	1.0	Left
TRIBUTARY	3275.8	0.5	Right
TRIBUTARY	488.8	0.5	Right



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Lance Creek, summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Jones Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Lance Creek, summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Jones Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Stream:	Big Stamp Creek
District:	Toccoa
USGS Quadrangle:	Nimblewill
Survey Date:	07/18/2001
Downstream Starting Point:	Confluence with Jones Creek
Total Distance Surveyed (km):	1.8

	Pools	Riffles
Percent of Total Stream Area:	30	70
Number:	91	63
Number per km:	51	35
Total Area (m ²):	1710±38	4041±316
Mean Area (m ²):	19	64
Correction Factor:	0.98	1.01
# of Paired Samples:	6	6
Mean Maximum Depth (cm):	38	23
Mean Average Depth (cm):	26	12
Mean Residual Pool Depth (cm):	11	--
% of Pool Habitat Surveyed as Glides:	0.0	--
% of Riffle Habitat Surveyed as Runs:	--	0.0
% of Riffle Habitat Surveyed as Cascades:	--	9.5
% Pools with > 35% Embeddedness:	97	79

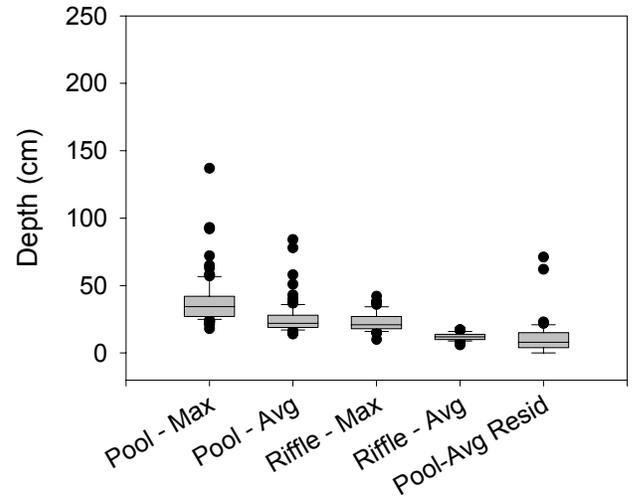
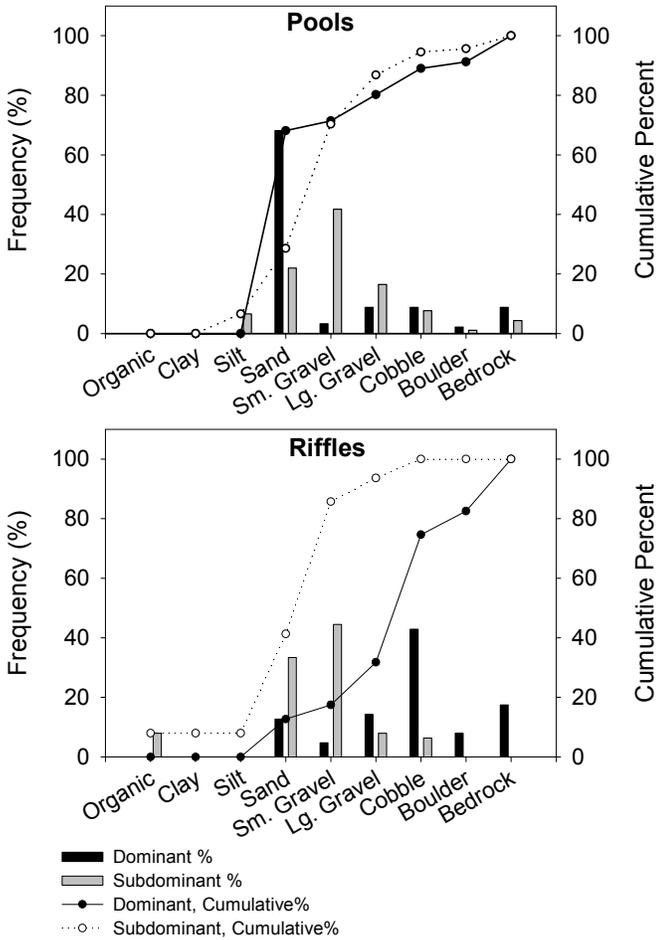
Large Woody Debris Size	Pieces per km
< 5 m long, 5 cm – 10 cm diameter:	55
< 5 m long, 11-50 cm diameter:	71
< 5 m long, >50 cm diameter:	1
> 5 m long, 5 cm – 10 cm diameter:	0
> 5 m long, 11-50 cm diameter:	40
> 5 m long, >50 cm diameter:	0
Rootwads:	1
Total:	167

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	9	2
Maximum	19	13
75 th Percentile	11	2
25 th Percentile	5	0
Minimum	4	0

*Left riparian, right riparian, and bankfull channel widths were added together for calculations

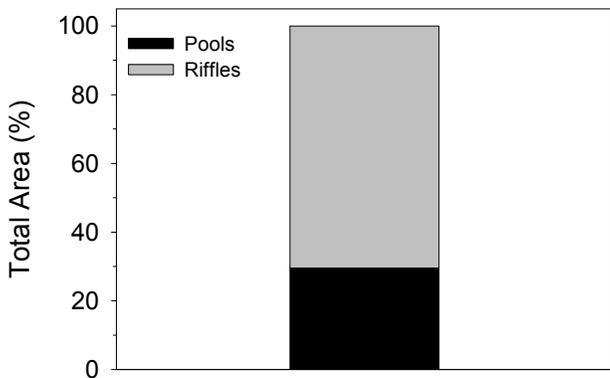
**Left and right riparian widths were grouped (not added) together for calculations

Other Stream Attributes	
Mean Bankfull Channel Width (m):	4
Mean Channel Gradient (%):	7

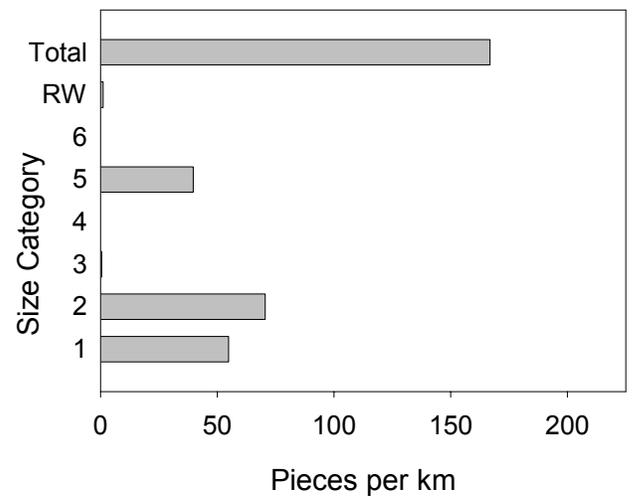


Maximum and average depths and residual pool depths for pools and riffles in Big Stamp Creek, summer 2001. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.

Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Big Stamp Creek, summer 2001.



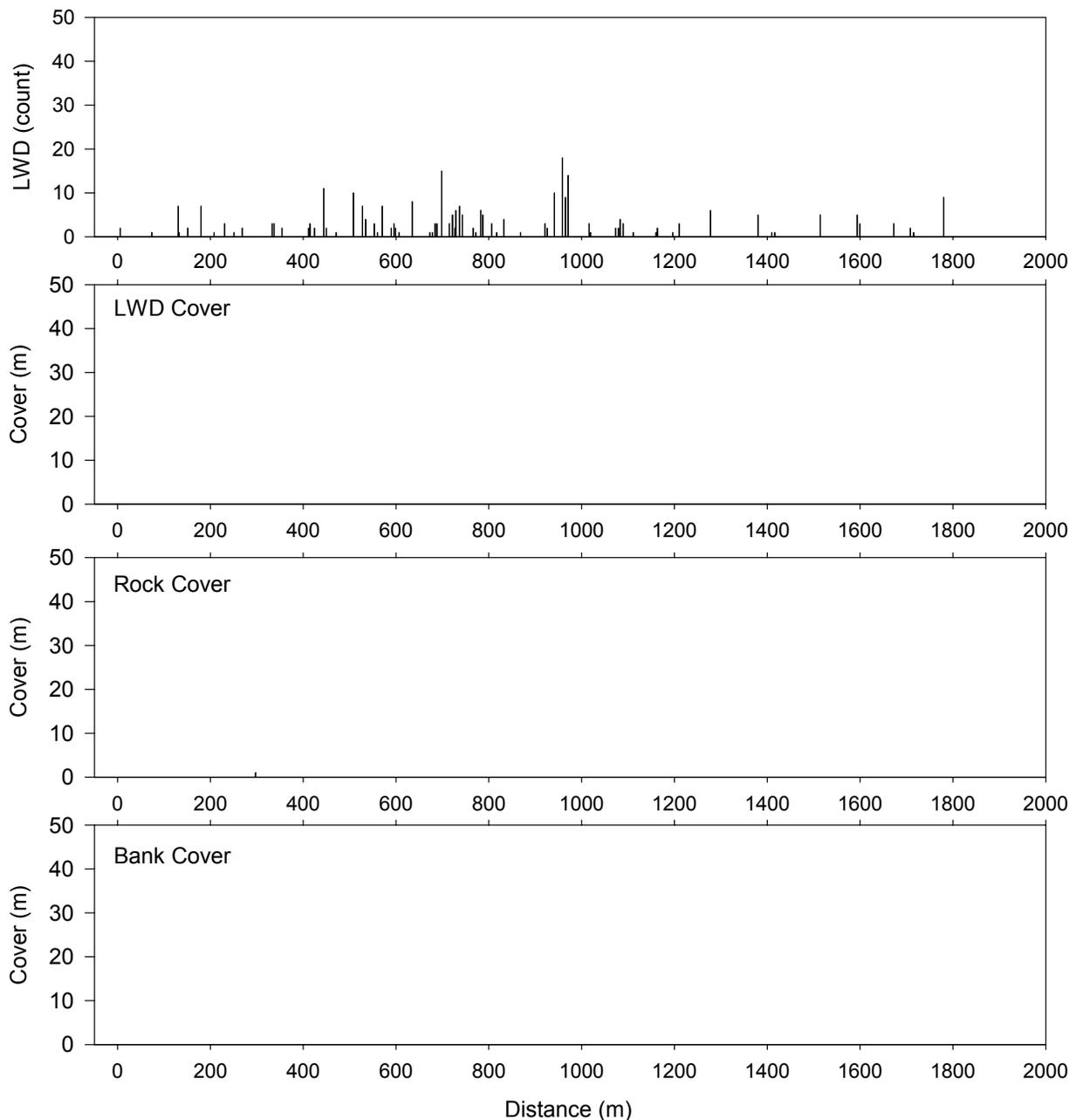
Estimated area of Big Stamp Creek in pools and riffles as calculated using BVET techniques, summer 2001.



LWD per kilometer in Big Stamp Creek, summer 2001.

Stream features found on Big Stamp Creek during BVET habitat survey, summer 2001. Distance is meters from confluence with Jones Creek.

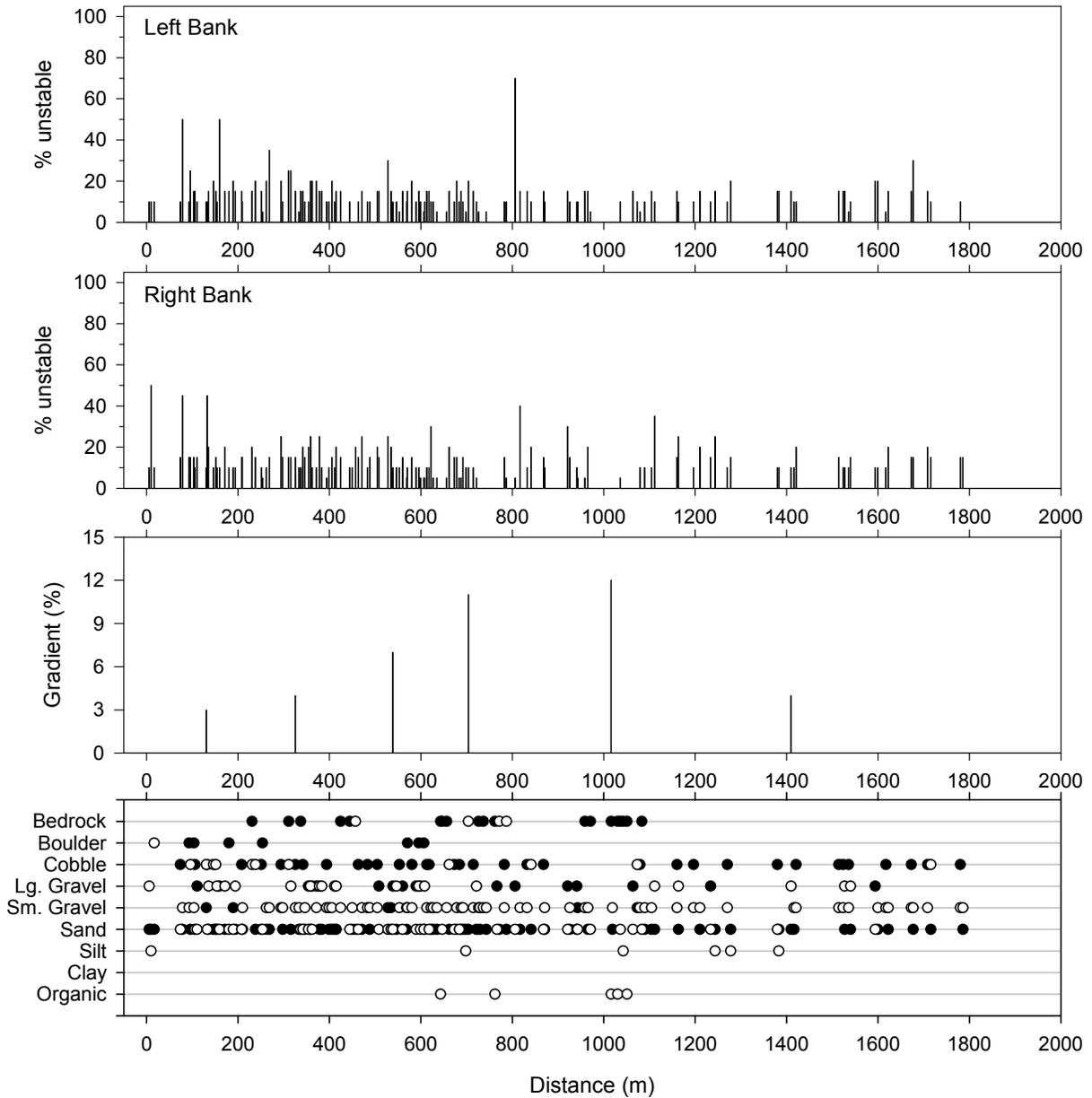
Stream Feature	Distance (m)	Width (m)	Comments
TRIBUTARY	293.9	1	Right
TRIBUTARY	547.7	0.5	Left
TRIBUTARY	890.1	0.25	
TRIBUTARY	1283.5	1	Left, good flow
TRIBUTARY	1313.3	0.7	Left
TRIBUTARY	1433.9	0.75	Left
TRIBUTARY	1674.9	1	Right
TRIBUTARY	1719.6	1.5	Left, 50/50 split



Distribution and abundance of LWD, and distribution of LWD, rock, and bank cover in Big Stamp Creek, summer 2001. LWD and cover were recorded for each habitat unit in the stream. Distance is meters upstream of confluence with Jones Creek.

LWD distribution and abundance: Vertical bars indicate total count of LWD. Open circles represent the amount of the total LWD that was >5 m in length, >50 cm in diameter (size 6).

LWD, rock, and bank cover: Cover was defined as linear meters of the cover type within the wetted channel under which a 15 cm long object could be hidden from overhead view. Vertical bars indicate amount of cover in linear meters.



Bank stability, gradient, and substrate distribution in Big Stamp Creek, summer 2001. Bank stability and substrate were recorded for each habitat unit in the stream. Gradient was measured in paired sample riffles. Distance is meters upstream of confluence with Jones Creek.

Bank stability: Left and right bank were recorded as looking upstream. Vertical bars indicate percent of bank identified as containing exposed erodible materials between the edge of the wetted channel and the top of the bankfull channel.

Substrate distribution: Closed circles indicate dominant substrate type, open circles indicate subdominant substrate type.

Appendix B: Fish Inventory Results

Table B1. Lengths and weights of fish measured during electrofishing in Jones Creek, summer 2001. Distance is meters upstream of confluence with Etowah River.

Unit Type	Unit Number	Distance (m)	Species	Length (mm)	Weight (g)	Comments
Pool	16	603.6	Redeye bass	192	100.3	
			Redeye bass	83	6.5	
			Redeye bass	91	8.2	
			Redeye bass	88	8.1	
Pool	36	1125.8	Brown trout	275	200.6	first trout captured
Pool	46	1385.8	Redeye bass	212	108.4	
			Redeye bass	80	6.1	
			Redeye bass	172	56.2	
			Redeye bass	88	7.3	
Pool	56	1616.9	Redeye bass	88	8.5	
			Redeye bass	93	11	
Riffle	26	1800.2	Redeye bass	92	8.2	
			Etowah darter	59	1.9	male
Pool	66	1926.5	Etowah darter	58	2.3	male
			Redeye bass	113	16.6	
Pool	76	2312.8	Brown trout	247	156.4	second trout captured
			Redeye bass	202	82.7	
			Redeye bass	156	42.5	
Riffle	36	2526.6	Redeye bass	183	78.3	
Riffle	46	3114.2	Brown trout	190	67.3	
			Brown trout	228	41.8	
			Brown trout	79	4.7	
			Brown trout	126	10	
Pool	116	3789.9	Brown trout	152	31.8	
			Brown trout	236	136	
			Brown trout	126	19.2	
Riffle	66	4430.9	Brown trout	74	3.7	
			Brown trout	400	763.4	
			Brown trout	192	74.5	
			Brown trout	121	14.9	
			Brown trout	78	4.7	
			Brown trout	67	2.9	
			Brown trout	135	23.7	
Riffle	76	4915.5	Brown trout	61	2.3	
			Brown trout	121	16.9	
			Brown trout	118	15.4	
			Brown trout	60	1.9	
Pool	156	5179.6	Brown trout	134	24.2	
			Brown trout	136	25.6	
			Brown trout	211	93.2	
Riffle	86	5700.6	Brown trout	73	2.7	
Pool	176	5918.8	Brown trout	149	33.4	
			Brown trout	122	16	
			Brown trout	244	143.8	
			Brown trout	206	79.7	

Table B2. Location and estimated number of species per habitat unit captured during 3-pass electrofishing in Jones Creek, summer 2001. Estimates (Est) with 95% confidence intervals (95CI) were only calculated when fewer fish were captured in each successive pass. Estimates for other habitat units is simply the sum of passes 1, 2, and 3. Distance is meters upstream of confluence with Etowah River.

Unit Type	Unit Num	Dist (m)	Species	Pass			Total	Est.	95CI +/-
				1	2	3			
Pool	6	151.5	Tricolor shiner	1	1	0	2	2	
			Blackbanded darter	2	2	0	4	4	
			Alabama hogsucker	5	0	0	5	5	
			Bronze darter	1	1	0	2	2	
			Yellowfin shiner	8	1	1	10	10	
Riffle	6	256.9	Alabama shiner	4	0	0	4	4	
			Banded sculpin	0	3	0	3	3	
			Alabama hogsucker	2	1	0	3	3	0.6
			Yellowfin shiner	3	1	0	4	4	0.4
			Bronze darter	0	1	0	1	1	
Pool	16	603.6	Blackbanded darter	0	2	0	2	2	
			Tricolor shiner	9	6	2	17	20	4.5
			Creek chub	4	0	0	4	4	
			Bronze darter	4	1	0	5	5	0.3
			Banded sculpin	4	3	0	7	7	1.4
			Alabama hogsucker	25	8	8	41	41	
			Alabama shiner	5	4	2	11	15	7.6
			Yellowfin shiner	29	35	15	79	79	
			Bluehead chub	3	6	3	12	12	
			Blackbanded darter	8	5	3	16	21	7.3
			Redeye bass	3	4	1	8	8	
			Coosa shiner	0	1	3	4	4	
			Largescale stoneroller	1	0	0	1	1	
Riffle	16	969.1	Bluehead chub	0	0	1	1	1	
			Yellowfin shiner	19	4	1	24	24	1.1
			Banded sculpin	6	4	2	12	15	5.6
			Alabama hogsucker	2	0	0	2	2	
			Bronze darter	1	0	1	2	2	
Pool	36	1125.8	Blackbanded darter	0	1	0	1	1	
			Bronze darter	0	1	0	1	1	
			Bluehead chub	5	1	1	7	7	
			Creek chub	3	1	0	4	4	0.4
			Banded sculpin	2	0	1	3	3	
			Alabama hogsucker	2	1	0	3	3	0.6
			Yellowfin shiner	20	4	3	27	28	2.1
			Brown trout	1	0	0	1	1	
Pool	46	1385.8	Bluehead chub	4	3	4	11	11	
			Bronze darter	0	1	0	1	1	
			Creek chub	0	2	0	2	2	
			Yellowfin shiner	16	16	6	38	38	
			Alabama hogsucker	13	3	7	23	23	
			Blackbanded darter	6	1	3	10	10	
			Redeye bass	2	3	0	5	5	
			Banded sculpin	4	2	3	9	9	

Unit Type	Unit Num	Dist (m)	Species	Pass			Total	Est.	95CI +/-
				1	2	3			
Pool	56	1616.9	Bluehead chub	19	7	3	29	31	3.1
			Yellowfin shiner	28	19	4	51	57	6.0
			Alabama hogsucker	17	9	4	30	34	5.4
			Redeye bass	1	0	1	2	2	
			Banded sculpin	1	0	0	1	1	
			Creek chub	14	11	2	27	30	4.9
			Bronze darter	0	0	1	1	1	
			Blackbanded darter	1	1	0	2	2	
			Bluehead chub	3	1	0	4	4	0.4
			Banded sculpin	16	9	2	27	29	3.5
Riffle	26	1800.2	Alabama hogsucker	2	1	0	3	3	0.6
			Creek chub	1	1	0	2	2	
			Etowah darter	0	2	0	2	2	
			Yellowfin shiner	0	3	1	4	4	
			Blackbanded darter	1	0	0	1	1	
			Bronze darter	4	2	0	6	6	0.8
			Bronze darter	1	0	0	1	1	
			Redeye bass	1	1	0	2	2	
			Blackbanded darter	0	1	0	1	1	
			Alabama hogsucker	11	1	1	13	13	
Pool	66	1926.5	Bluehead chub	2	2	1	5	5	
			Banded sculpin	1	0	0	1	1	
			Largescale stoneroller	0	0	1	1	1	
			Brown trout	0	1	0	1	1	
			Yellowfin shiner	2	2	0	4	4	
			Creek chub	1	0	0	1	1	
			Redeye bass	0	0	1	1	1	
			Bronze darter	0	1	0	1	1	
			Blackbanded darter	0	1	0	1	1	
			Alabama hogsucker	0	2	1	3	3	
Pool	76	2312.8	Bluehead chub	1	0	0	1	1	
			Banded sculpin	0	3	0	3	3	
			Yellowfin shiner	4	8	1	13	13	
			Alabama hogsucker	8	1	0	9	9	0.2
			Yellowfin shiner	18	3	2	23	23	1.4
			Redeye bass	1	0	0	1	1	
			Bronze darter	1	4	1	6	6	
			Creek chub	3	2	1	6	8	4.0
			Banded sculpin	2	1	2	5	5	
			Blackbanded darter	1	0	0	1	1	
Pool	86	2608.6	Bluehead chub	2	4	0	6	6	
			Banded sculpin	2	0	0	2	2	
			Bronze darter	1	0	0	1	1	
			Alabama hogsucker	3	2	1	6	8	4.0
			Largescale stoneroller	2	0	0	2	2	
			Bluehead chub	4	0	0	4	4	
			Creek chub	3	1	1	5	5	
			Yellowfin shiner	11	1	0	12	12	0.2

Unit Type	Unit Num	Dist (m)	Species	Pass			Total	Est.	95CI +/-
				1	2	3			
Glide	96	2956.5	Brown trout	1	1	0	2	2	
			Creek chub	5	6	3	14	14	
			Alabama hogsucker	5	2	0	7	7	0.7
Riffle	46	3114.2	Banded sculpin	1	2	2	5	5	
			Creek chub	0	3	3	6	6	
			Alabama hogsucker	2	0	0	2	2	
			Brown trout	2	0	0	2	2	
			Bronze darter	1	1	0	2	2	
Pool	106	3386.2	Banded sculpin	1	1	1	3	3	
			Alabama hogsucker	12	8	2	22	25	4.2
			Banded sculpin	3	2	0	5	5	1.0
Pool	116	3789.9	Creek chub	50	20	15	85	99	10.1
			Brown trout	2	0	1	3	3	
			Banded sculpin	2	3	0	5	5	
Riffle	56	3801.1	Alabama hogsucker	4	0	1	5	5	
			Creek chub	11	9	4	24	32	10.1
			Alabama hogsucker	1	0	0	1	1	
Pool	126	4162.1	Banded sculpin	1	1	1	3	3	
			Creek chub	24	31	35	90	90	
			Brown trout	0	0	3	3	3	
Riffle	66	4430.9	Banded sculpin	2	1	2	5	5	
			Alabama hogsucker	11	10	6	27	47	22.4
			Bronze darter	1	0	0	1	1	
			Creek chub	13	0	6	19	19	
			Alabama hogsucker	4	0	0	4	4	
Pool	136	4598.2	Brown trout	6	1	0	7	7	0.3
			Banded sculpin	2	3	2	7	7	
			Bronze darter	2	1	0	3	3	0.6
			Banded sculpin	2	1	4	7	7	
			Alabama hogsucker	4	3	2	9	14	9.7
Riffle	76	4915.5	Creek chub	46	20	20	86	86	
			Bronze darter	5	1	1	7	7	
			Banded sculpin	11	4	5	20	20	
			Creek chub	17	8	1	26	27	2.2
			Brown trout	1	2	1	4	4	
Pool	146	4925.7	Alabama hogsucker	3	1	1	5	5	
			Banded sculpin	0	1	0	1	1	
			Bronze darter	2	0	1	3	3	
			Alabama hogsucker	7	3	1	11	12	2.0
Pool	156	5179.6	Creek chub	14	6	5	25	31	7.1
			Banded sculpin	2	0	0	2	2	
			Bronze darter	1	0	0	1	1	
			Creek chub	24	11	0	35	36	1.8
Riffle	86	5700.6	Brown trout	0	1	1	2	2	
			Alabama hogsucker	13	1	0	14	14	0.1
			Brown trout	1	0	0	1	1	
			Creek chub	17	2	3	22	22	
			Alabama hogsucker	2	0	1	3	3	
			Banded sculpin	5	1	5	11	11	

Unit Type	Unit Num	Dist (m)	Species	Pass			Total	Est.	95CI +/-
				1	2	3			
Pool	176	5918.8	Alabama hogsucker	25	7	5	37	39	3.7
			Creek chub	23	7	5	35	38	4.1
			Banded sculpin	1	2	1	4	4	
			Brown trout	3	1	0	4	4	0.4

Appendix C: Habitat Inventory Categories

Table C1. Description of habitat types used during BVET habitat surveys, modified from Armantrout (1998).

Habitat Type	Stream Bed Profile	Gradient (%)	Surface Turbulence	Water Velocity
Pool	concave	<1	none	low
Glide	flat	<1	none	low
Run	flat	>1	low to none	high
Riffle	convex	>1	moderate to high	high
Cascade	convex	>12%	very high	very high

Table C2. Substrate size classes used during BVET habitat surveys based on modified Wentworth scale. Diameter was visually estimated for the intermediate axis.

Size Class	Name	Size (mm)	Description
1	Organic	--	Dead organic matter, leaves, detritus, etc.
2	Clay	< 0.00024	Sticky
3	Silt	0.00024-0.0039	Slippery
4	Sand	0.0039-2	Gritty
5	Small Gravel	3-16	Sand to thumbnail
6	Large Gravel	17-64	Thumbnail to fist
7	Cobble	65-256	Fist to head
8	Boulder	>256	Larger than head
9	Bedrock	--	Solid parent material

Table C3. Large woody debris (LWD) size classes used during BVET habitat surveys. Diameter was measured at thickest portion of LWD piece. All woody debris less than 1 m long and less than 5 cm in diameter were omitted from the survey.

Size Class	Length (m)	Diameter (cm)
1	< 5	5 – 10
2	< 5	10 – 50
3	< 5	> 50
4	> 5	5 – 10
5	> 5	10 – 50
6	> 5	> 50
7	rootwad	rootwad